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AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

ISSUED WEEKLY BY THE HILL PUBLISHING COMPANY,

Vol. 31. 505 PEARL STREET, NEW YORK. No. 53.

Index to Advertisers and Classified Index Following Reading Matter.

STARRETT'S QUICK ADJUSTING MICROMETER

By a slight pressure of the finger on the plunger the nut is disengaged from the screw, and the micrometer may be INSTANTLY adjusted to any point within its capacity.

Get our Catalog No. 18 C. Which describes this tool in detail as well as hundreds of others needed in the outfits of first-class mechanics.

A tool which the mechanical world has been seeking for years. After long study and much experimenting we have at last produced a micrometer which can be *instantly* opened or closed to any point within its capacity. And this is done without impairing its accuracy or sensitiveness in the slightest degree. Forty complete revolutions of the screw are required to open or close an ordinary one inch micrometer its full length, taking approximately 20 seconds. This time is practically all saved by the use of our new tool.

To operate the micrometer it is only necessary to press with the finger against the end of the plunger. This immediately releases the nut, disengaging it from the screw, when any adjustment within an inch may be instantly made. Releasing the pressure, the nut instantly engages the screw, when fine adjustments may be made in the usual way.

This micrometer also has our patented sleeve, new lock nut and ratchet stop.
It will at once be recognized as a distinct advance in tools of this class; in fact it is in a class by itself.

THE L. S. STARRETT COMPANY

ATHOL, MASS. U.S.A.

New York 132 Liberty Street. London - 36-37 Upper Thames Street, E. C. Chicago 18-20 West Randolph Street.

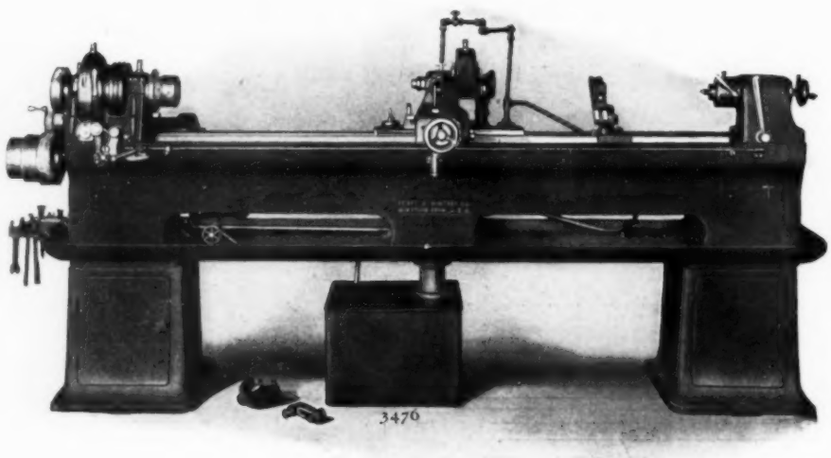
MILLING THREADS

is the modern way ensuring greatest accuracy as well as increased output.

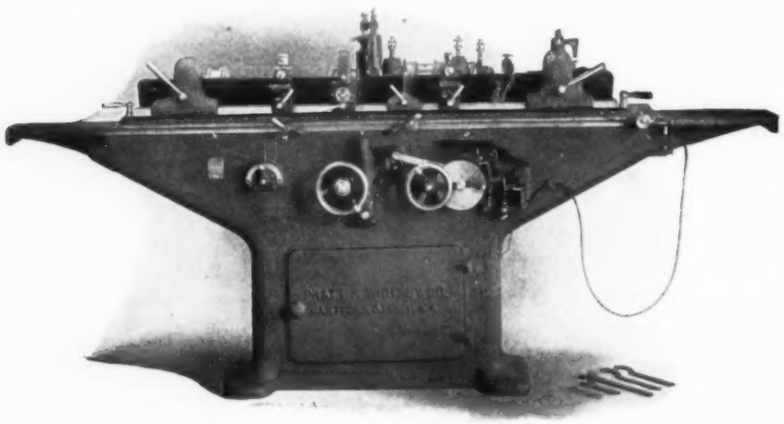
Soft or hard spots in the stock are not torn or chipped.

For screws, spiral gears, worms, flexible shafts, etc., the lathe cannot compete in accuracy, finish or output.

Write for Catalog
"Thread Milling Machines"



6x80 Inch P. & W. Thread Milling Machine—Built in 6 sizes.



The 5x48 P. & W. Automatic Sizing Grinder.

AUTOMATIC GRINDING TO WITHIN .0001 INCH

Removing the last thousandth, usually the most expensive part of a grinding operation, is done on the P. & W. Automatic Sizing Grinder at practically no cost.

The heavy coarse feed is automatically changed to a fine feed and work is quickly ground with a fine finish to exact size without calipering.

Machine measures faster and more accurately than any man can do it.

Wear of emery wheel has no effect whatever.

Write for Illustrated Circular

THE OPEN TURRET

Solid backing for tools as well as solid seat.

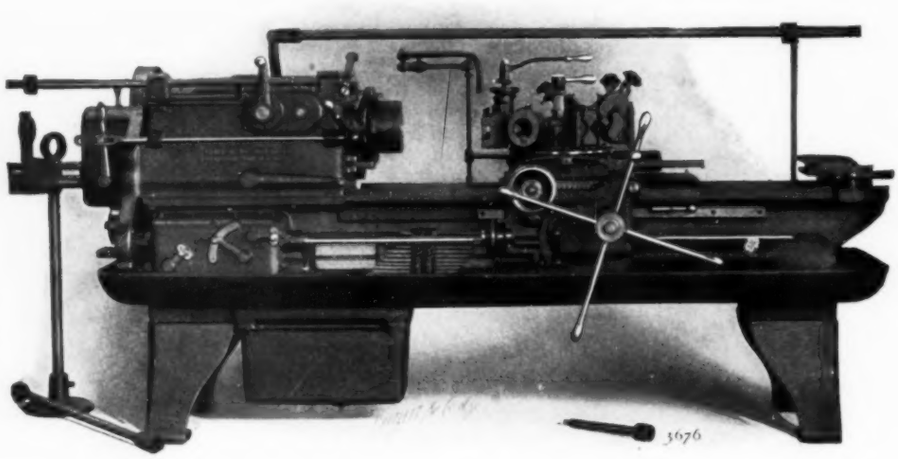
30% heavier than any turret lathe of its size.

Cross sliding turret with a broad base and narrow guide.

Stationary head stock, most practical and convenient for either belt or motor drive.

Positive turret binder.

Write for catalogue
"The Open Turret Lathe."



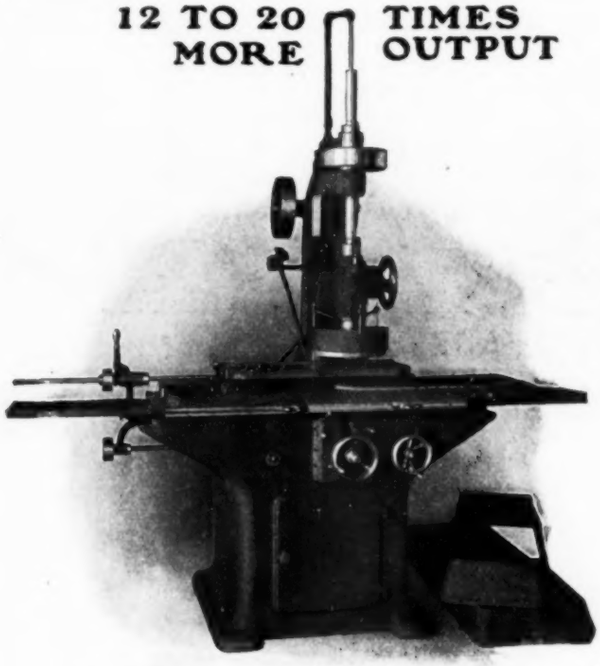
2½x26 P. & W. Open Turret Lathe—Cross Sliding Turret.

PRATT & WHITNEY COMPANY,

HARTFORD, CONN., U.S.A.

OFFICES—Trinity Building, 111 Broadway, New York. Boston: Oliver Bldg. Chicago: Commercial National Bank Bldg. Pittsburg: Frick Bldg. St. Louis: 516 North 3d St. Philadelphia: 21st and Callowhill Sts. Birmingham, Ala., Brown-Marx Bldg. Agents: California, Nevada and Arizona, Harron, Rickard & McCone, 461 Market St., San Francisco, Cal., and 164-8 North Los Angeles St., Los Angeles, Cal. The Canadian Fairbanks Co., Ltd., Montreal, St. John, Toronto, Winnipeg, Calgary and Vancouver. Japan, F. W. Horne, 70 C Yokohama.

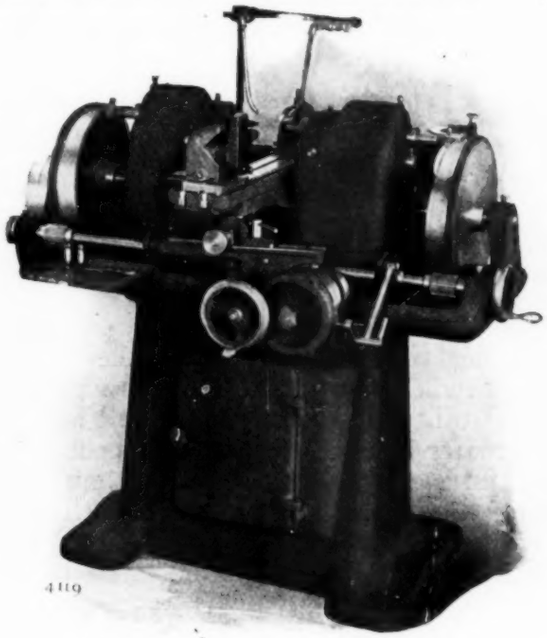
12 TO 20 TIMES MORE OUTPUT



The P&W Vertical Surface Grinding Machine.

MULTIPLE SPINDLE DRILLING MACHINE

with adjustable spindles for drilling simultaneously a number of holes in a great variety of work from an automobile nut to heavy vault plates.



4119

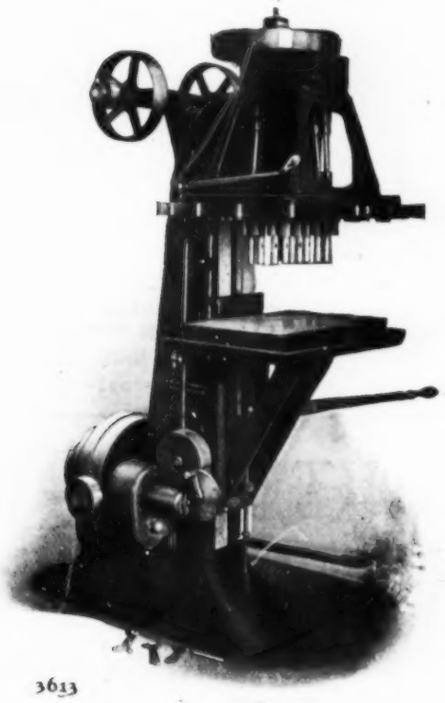
The P. & W. Spline Milling Machine.

The P. & W. Vertical Surface Grinder

will grind from 12 to 20 times faster than any other surface grinder. Cup shaped wheel covers full width of work ensuring perfect flatness together with rapid reduction.

Furnished with magnetic chuck (as shown) for holding flat work or with revolving table for discs, rings, collars, etc.

Write for Illustrated Circular.



3613

The P. & W. Adjustable Multi Spindle Drill.

SLOT MILLING

The P & W Spline Milling Machine is an entirely new machine for milling slots with closed ends, keyways and an endless variety of other work—greatly reducing the cost of production.

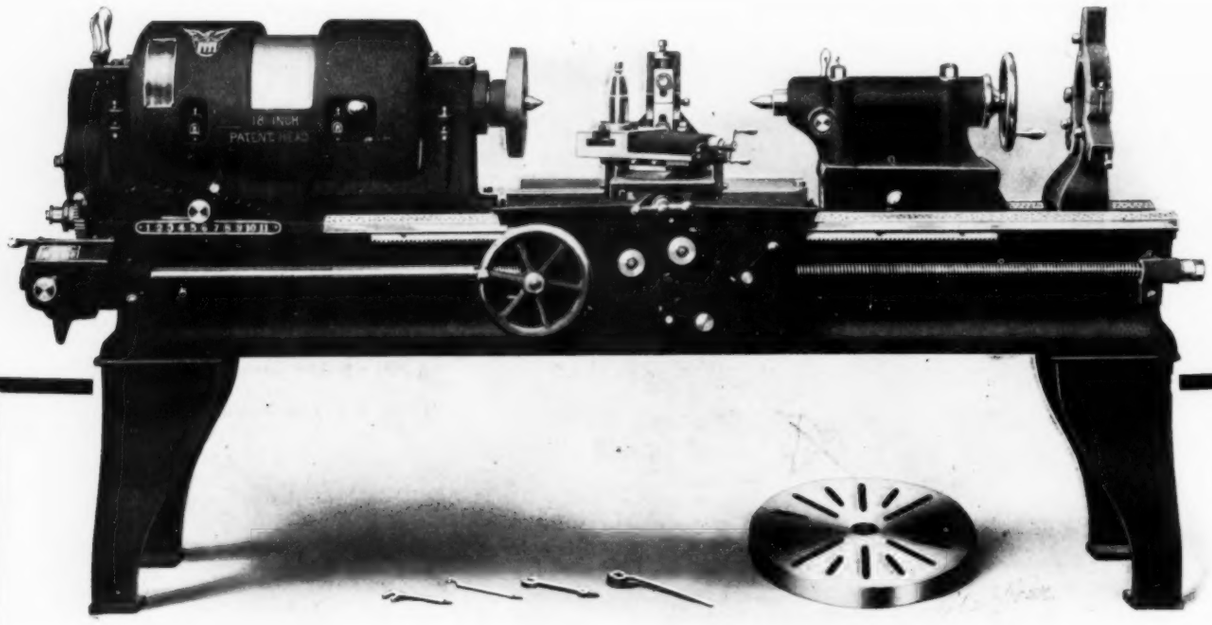
Machine is automatic, very rapid and accurate.

Complete Illustrated Catalog, "The Spline Milling Machine," mailed on request.

PRATT & WHITNEY COMPANY

HARTFORD, CONN., U. S. A.

OFFICES—Trinity Building, 111 Broadway, New York. Boston: Oliver Bldg. Chicago: Commercial National Bank Bldg. Pittsburg: Frick Bldg. St. Louis: 516 North 3d St. Philadelphia: 21st and Callowhill Sts. Birmingham, Ala., Brown-Marx Bldg. Agents: California, Nevada and Arizona, Harron, Rickard & McCone, 461 Market St., San Francisco, Cal., and 164-8 North Los Angeles St., Los Angeles, Cal. The Canadian Fairbanks Co., Ltd., Montreal, St. John, Toronto, Winnipeg, Calgary and Vancouver. Japan, F. W. Horne, 70 C Yokohama.



18″ Standard screw cutting Engine Lathe with Patent Head Drive, 4½″ belt over 12″ diameter driving pulley—six open belt speeds—six 3 to 1 back gear speeds—six 9 to 1 back gear speeds from 12 to 414 R P M of spindle—32 threads from 2 to 32 threads per inch—32 feeds from 5 to 80 per inch; both feed and thread changes can be made while lathe is running—Gearing of drop forged steel—headstock bearings ring oiled.

ISN'T THIS WHAT YOU'VE BEEN HUNTING FOR SOME TIME—

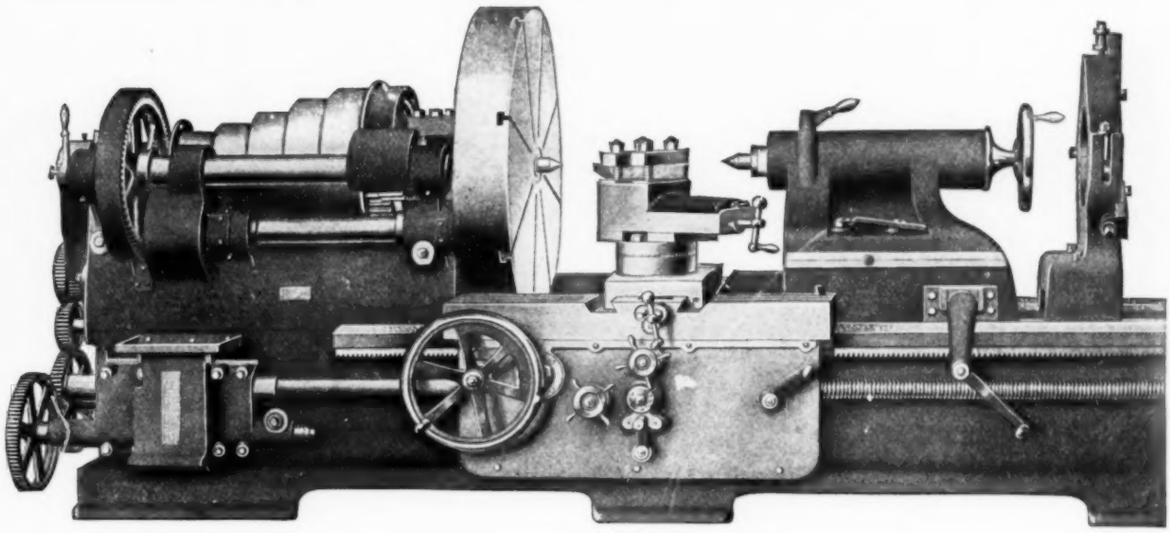
a stiff powerful lathe with low center distances, capable of handling all kinds of lathe work, with power?

An 18″ Patent Head Lathe has the spindle bearings of a 20″ cone head lathe—the bridge of the carriage is short and is broader and deeper than found on a 24″ cone lathe—the tailstock has the weight of a 22″ tailstock—the width of belt is greater than that used on a 30″ 5 step cone—greater belt contact for all speeds than on a 22″ cone head lathe—less belt pull and gear thrust on a spindle than can be found on any cone head engine lathe of any make or size, since both driving pulley and gears are carried on sleeve, feed from spindle support—the most powerful lathe, retaining the greatest number of open belt speeds, offered for working high speed steel.

The Lodge & Shipley Machine Tool Company

Cincinnati, Ohio, U. S. A.

CANADA AGENTS—H. W. Petrie, Ltd., Toronto and Montreal.
EUROPEAN AGENTS—Alfred H. Schutte, Cologne, Paris, Brussels, Liege, Barcelona, Bilbao, Milan; Chas. Churchill & Co., Ltd., London, Birmingham, Manchester, Glasgow, Newcastle-on-Tyne; V. Loewener, Copenhagen, Stockholm, Chrsitiania; R. S. Stokvis & Zonen, Rotterdam; Soerabaya, Java; Schuchardt & Schutte, Berlin, Vienna, Budapest, St. Petersburg; Werner Hult, Helsingford, Finland.
OTHER AGENTS—Bevan & Edwards, Melbourne, Australia; Adolfo B. Horn, Havana; Andrews & George, Yokohama.



Bradford Lathes

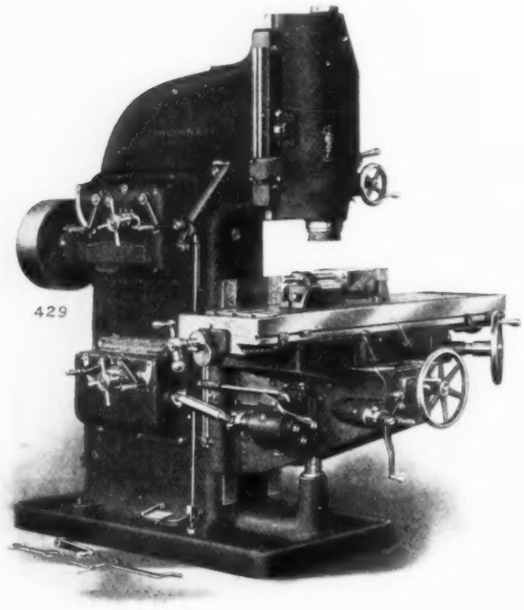
By selecting a Bradford Lathe you get—
A Lathe whose name stands foremost among the tools manufactured in America—
Whose growth in popularity has been substantial and continuous—
A Lathe that is in active operation in every quarter of the globe—
A Lathe whose manufacture represents the undivided attention of a concern that devotes its large works and expensive equipment *exclusively* to the building of metal working lathes—
A Lathe that eliminates all doubt and uncertainty as to its subsequent operation.
Can you afford to give time to considering any other?
Bradford Lathes, from 14" to 25" inclusive, can now be furnished with either 3 or 4-step cone pulley as well as our regular 5-step cone.
Write for the Bradford Catalog.

THE BRADFORD MACHINE TOOL CO.
Cincinnati, Ohio, U. S. A.

Vandyck, Churchill Co., New York and Philadelphia, Eastern Agents. Pacific Tool & Supply Co., San Francisco, Cal., Agents for Pacific Coast
FOREIGN AGENTS—Chas. Churchill & Co., Ltd., London, Birmingham, Manchester, Glasgow, Newcastle-on-Tyne. Schuchardt & Schutte, Berlin, Vienna, St. Petersburg, Stockholm, Copenhagen and Budapest. Alfred H. Schutte, Cologne, Brussels, Liege, Paris, Milan and Bilbao. F. W. Horne, Japan, China, and Far East.

Power, Convenience

THESE three features have been achieved in the feed works of Cincinnati High Power Millers. Its Power is entirely a matter of dimensions and we invite comparison with others.



ITS CONVENIENCE or handiness in operation is due to—

The index plate, which tells the exact lever movements required; the easiness of these lever movements; their location high above the floor and on the operator's side; few and simple parts permitting changing under all conditions, while running —move two levers at a time if you wish; the feed operating levers are also reverse levers for *all feeds*, and always indicate which way the table will move; single plunger trip allows engaging any one of the three feeds, from a tripped position without running off the dogs by hand.

The Cincinnati Milling Machine Co.

Cincinnati, Ohio, U. S. A.

European Agents—Schuchardt & Schutte, Berlin, Vienna, Stockholm, St. Petersburg, Copenhagen and Budapest. Alfred H. Schutte, Cologne, Brussels, Liege, Milan, Paris, Turin, Barcelona and Bilbao. Charles Churchill & Co., London, Birmingham, Manchester, Newcastle-on-Tyne and Glasgow.

Canada Agent—H. W. Petrie, Ltd., Toronto, Montreal and Vancouver.

Australian Agents—Thos. McPherson & Son, Melbourne.

High Efficiency

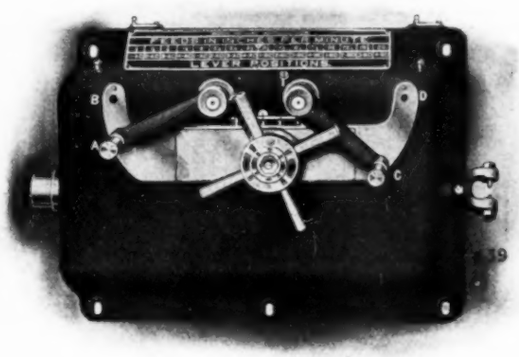
ITS HIGH EFFICIENCY results from—

The few parts; no shafts working under combined torsional and bending strains; never any gears in mesh except those doing useful work; tumbler gear frame firmly clamped at all positions; quick pitch feed screws; feed tripping clutch on fast running shaft, therefore quick acting and very sensitive; no gears in knee running except those required for the feed being used.

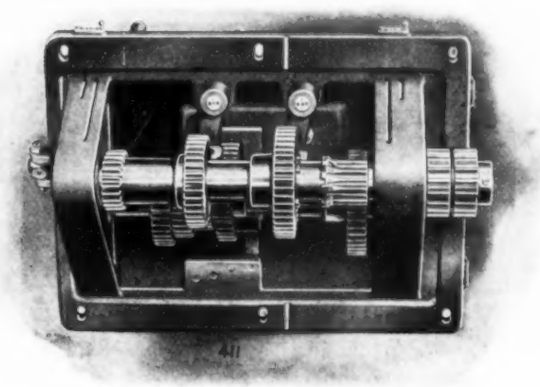
All these things cause easy running, eliminate vibration and make for high efficiency.

The highly efficient and convenient feed alone enables our High Power Millers to do more work and use less power in doing it.

GET OUR HIGH POWER MILLER CATALOG



THE FEED BOX
This remains the same for feeds driven from spindle or from constant speed shaft



INTERIOR OF FEED BOX
This is the complete mechanism for providing the 16 changes of feed

The Cincinnati Milling Machine Co.

Cincinnati, Ohio, U.S.A.

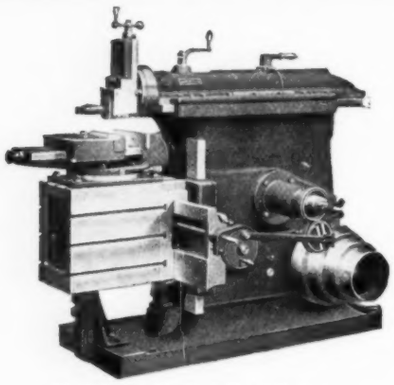
THE

AMERICAN

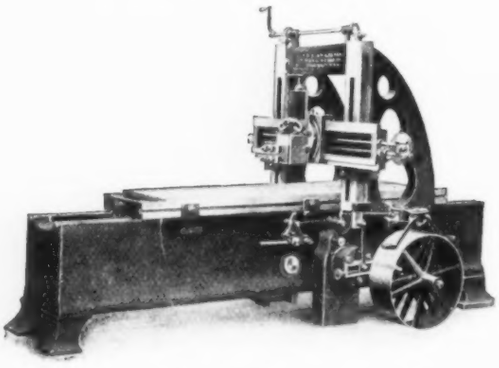
TOOL WORKS COMPANY,

100 TO 150 CULVERT ST.,

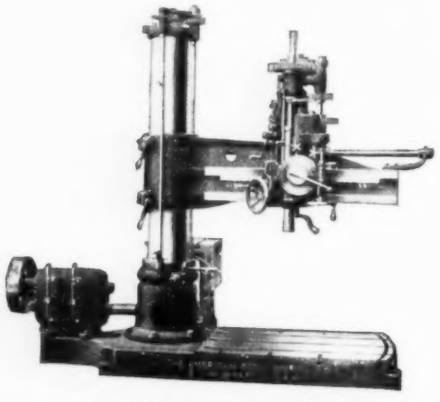
CINCINNATI, OHIO, U. S. A.



Shapers—15" to 28" Stroke.



Planers—22" to 72" Between Housings.



Radial Drills 2' to 7' Arm.

INTELLIGENT SELECTION

(REGARDLESS OF FIRST-COST)

OF TOOLS FOR YOUR SHOP EQUIPMENT

WILL RESULT IN

MAXIMUM OUTPUT
LOWEST SHOP COST
BEST QUALITY OF WORK
SATISFIED CUSTOMERS
GREATEST PROFITS

"AMERICAN" TOOLS

REPRESENT THE

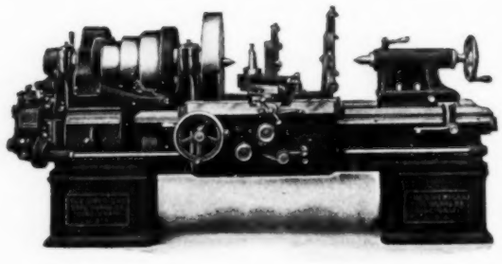
HIGHEST DEVELOPMENT OF MODERN DESIGN

THEY ARE BUILT FOR HARD SERVICE AND ARE **NOTED** FOR THEIR

Power **Accuracy**
Simplicity **Durability**

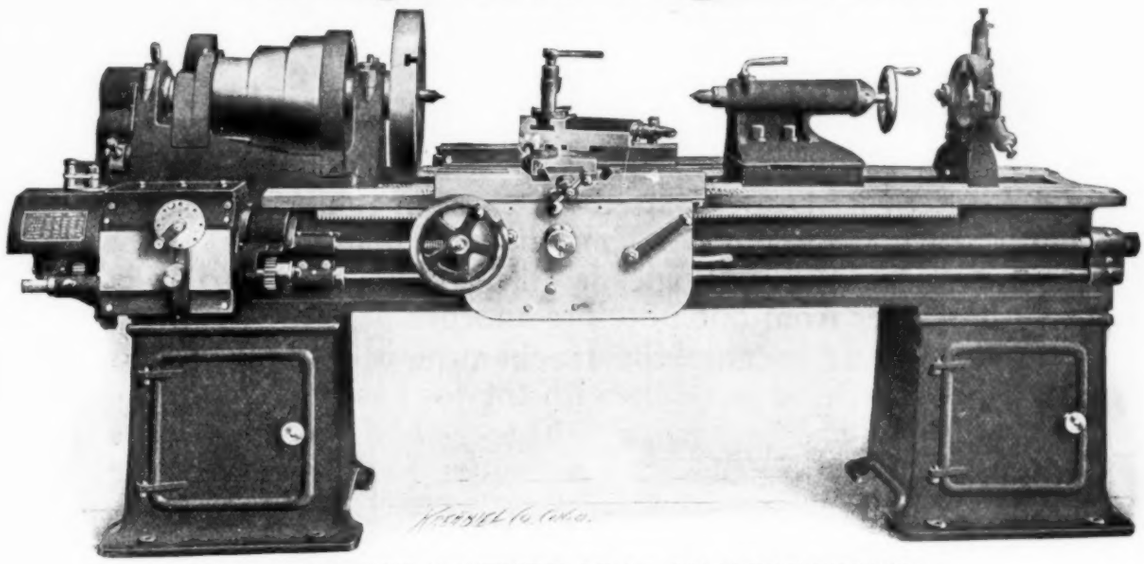
Send for Catalog G.

Belt or Motor Driven.



Lathes—14" to 48" Swing.

20-Inch Double Back Geared Instantaneous Change Gear Engine Lathe



ENGINE LATHES 18 to 48 INCH SWING

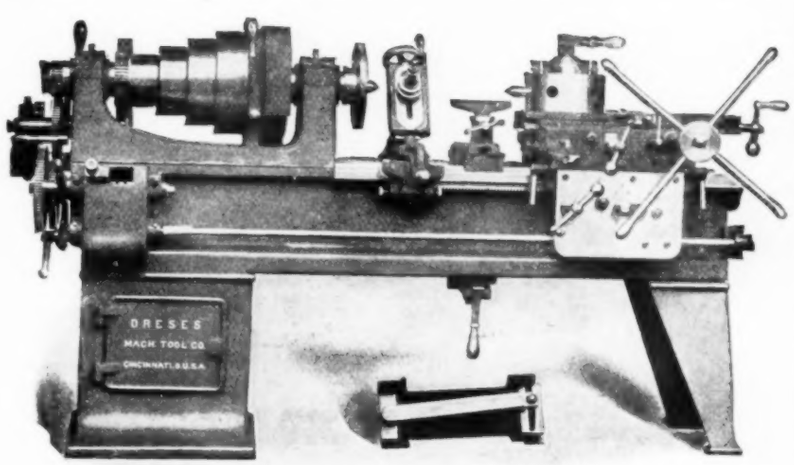
SCHUMACHER & BOYE

CINCINNATI, OHIO, U. S. A.

AGENTS—Manning, Maxwell & Moore, Inc., New York City, Chicago, Boston, Philadelphia, Syracuse, St. Louis, Birmingham, Atlanta. The Baird Machinery Co., Pittsburg, Pa. The Strong, Carlisle & Hammond Co., Cleveland, O., Detroit, Mich. The Northwest Machinery Co., Spokane, Wash. The Perine Machinery Co., Seattle, Wash. Pacific Coast Mfg. Co., Los Angeles, Cal. Henshaw, Bulkley & Co. San Francisco Rice, Lewis & Son, Ltd., Toronto, Ont.

The Latest Designs In Turret Brass Lathes

A few of its important features are: Geared feed so proportioned that it cuts 8, 11½, 14 and 18 (pipe) threads and others without change; 8 changes of geared feed instantly obtainable; screw feed to turret slide for fine adjustment. Friction back geared head of the simplest design; straight and taper turning and screw cutting by means of turret and power feed; semi-automatic turret; chasing bar cuts right and left hand threads without changing, etc. Ask for circular telling all the features.



All Sizes and Styles of

Turret Lathes

20" Full Universal Monitor Lathe

DRESES MACHINE TOOL CO., Cincinnati, Ohio, U.S.A.

REPRESENTATIVES: The Fairbanks Co., New York, Philadelphia and Montreal; Carey Machy. and Supply Co., Baltimore; O. L. Packard Machinery Co., Chicago and Milwaukee; Wm. C. Johnson & Sons Machinery Co., St. Louis; The Strong, Carlisle & Hammond Co., Detroit; Vandyck, Churchill Co., Pittsburg; Pacific Tool and Supply Co., San Francisco; Selig, Sonnenthal & Co., London; E. Sonnenthal, Jr., Berlin and Koln; Wilh. Sonesson & Co., Malmo, Sweden; Stussi & Zweifel, Milan, Italy; Alfred Herbert, Ltd., Paris, France; White, Child & Beney, Vienna, Austria.

Bickford Improved Radial Drills

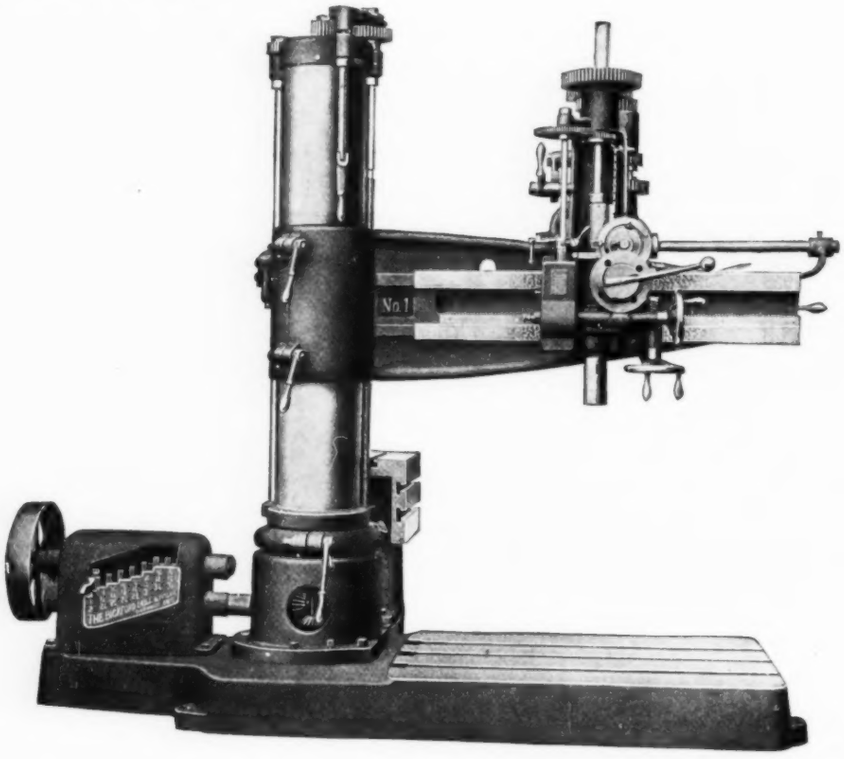
Built in three sizes: 4, 5 and 6 feet.

THE SPEED BOX used on these machines gives instantly, with a single lever, *eight* changes of speed.

In order to change speeds all the operator has to do is to *toss* the lever from one notch to another.

We say *toss* because the mechanism is fool-proof, and can be manipulated as safely with the foot as the hand.

And that the box lacks neither *power* or *durability* is attested by the unqualified satisfactory performance of the hundreds in use.



We also make 2½, 3 and 3½ Foot Radials.

THE BICKFORD DRILL & TOOL COMPANY,

CINCINNATI, OHIO, U. S. A.

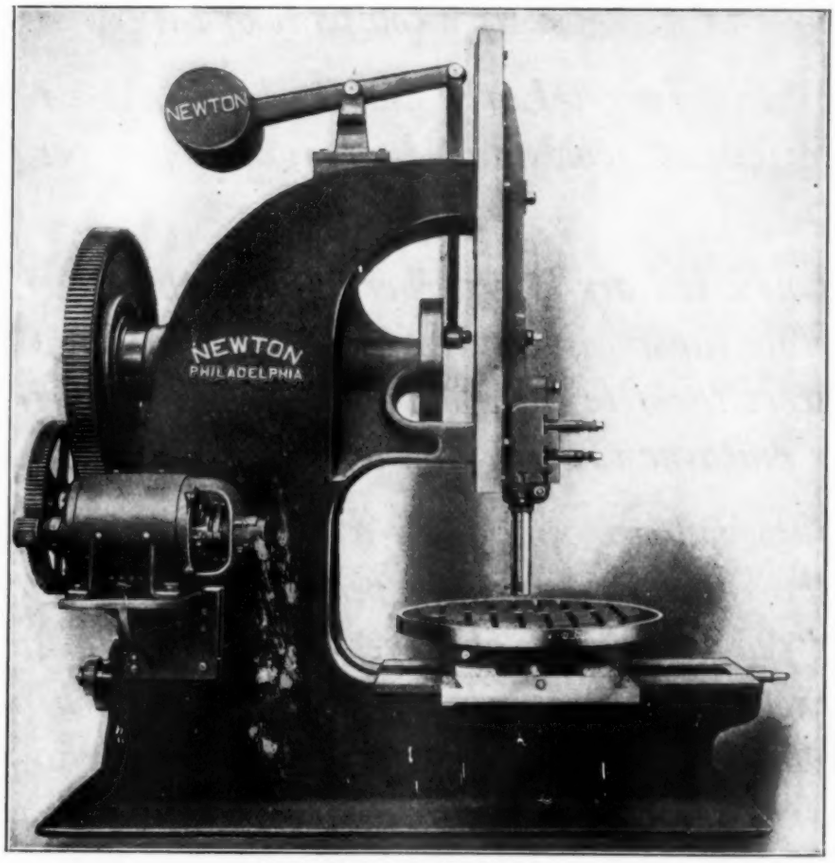
DOMESTIC AGENTS—Prentiss Tool and Supply Co., New York City, Boston, Buffalo and Syracuse. Marshall & Huschart Machinery Co., Chicago, Ill. Motch & Merryweather Machinery Co., Cleveland and Detroit. Cotton States Belting and Supply Co., Atlanta, Ga. The Fairbanks Co., Baltimore, Md. Scott Supply and Tool Co., Denver, Colorado. Vonnegut Hardware Co., Indianapolis, Ind. Harron, Rickard & McCone, San Francisco and Los Angeles, Cal. C. T. Paterson Co., Ltd., New Orleans, La. W. E. Shipley Machinery Co., Philadelphia, Pa. Brown & Zortmann Machinery Co., Pittsburg, Pa. Hallidie Machinery Co., Seattle and Spokane, Wash. W. R. Colcord Machinery Co., St. Louis, Mo. Robinson & Cary Co., St. Paul, Minn.

No. 10. Series I-3

NEWTON

(Registered Trade Mark.)

High Duty Rail Drilling Machines
Portable and Fixed Rotary Planing Machines
Vertical and Horizontal Chord Boring Machines



20" Slotting Machine

Machine] illustrated above has a maximum stroke of 20½" and is driven by a variable speed motor. Ram is shown carrying an auxiliary cutter-bar having independent circular adjustment for slotting fillets.

NEWTON MACHINE TOOL WORKS, INC.,

PHILADELPHIA, U. S. A.

Study The Lathe Question Yourself

In considering "tuning up" your plant by correcting your lathe methods, bear in mind that the Jones & Lamson Machine Co. is a company of lathe specialists.

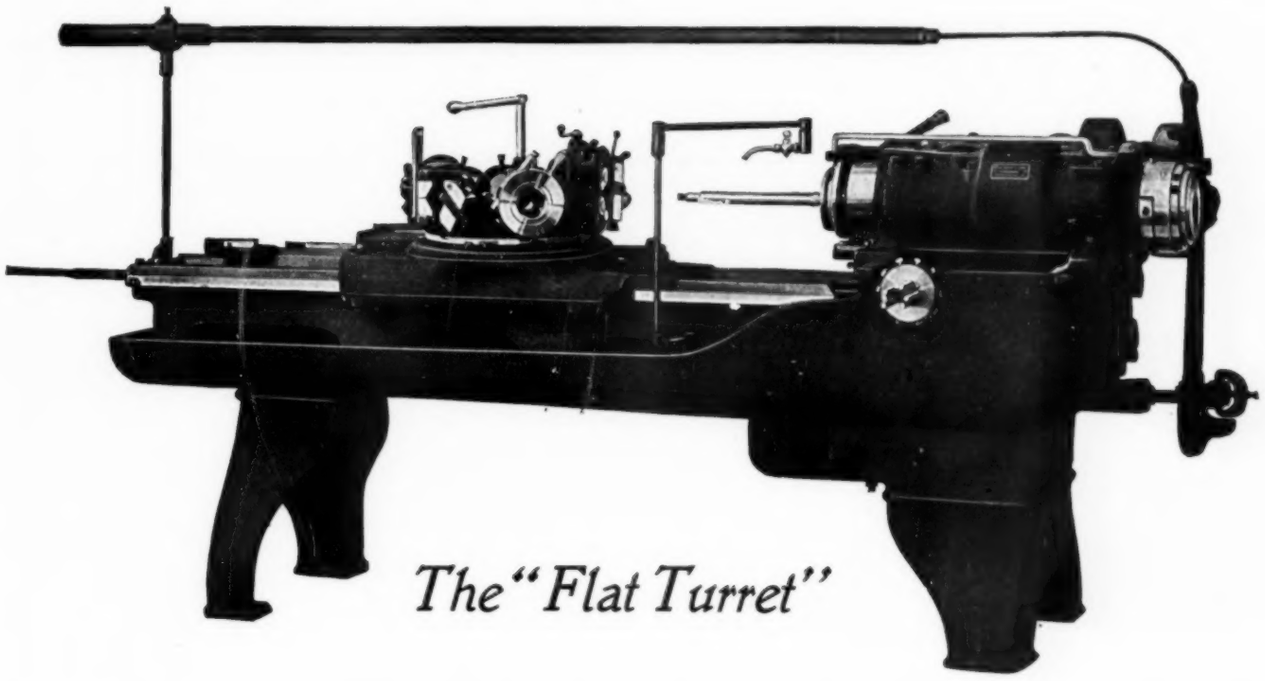
The Flat Turret Lathe has the lead in cost reducing duplication of work and in large output per dollar of cost.

Just now the air is reverberating with the wild note of the low labor cost enthusiast, who would have manufacturers throttle their output by putting their capital for machine tools in low output machines.

What good can come from a system that would reduce the cost of machining per piece 99 9-10 (99.9) % if said reduction were obtained by machines of such low efficiency that the available capital for machine tools would not get out one-tenth the required work. These are extravagant figures to illustrate the point.

The output of your plant when business is good determines your profit. Your output cannot be larger than your capacity to machine your work—in fact, the capacity to machine the work usually determines the output.

Jones & Lamson Machine Co.,



The "Flat Turret"

Now, is your business to be throttled by the use of low output machines or do you want to get out the work when it is wanted?

To offset the profit in good times we have the idleness of capital in dull times. This loss is great enough when the capital is in high efficiency machines.

Don't be deceived by the song of the enthusiast of saving the last fraction of cent of labor cost. He usually does it by expensive, short lived, frail, inadaptable tools which become obsolete with change of work. His machines when in use a few months average to be found idle too much of the time. Go through your own or other plants with this thought in mind.

Send for our book "The Hartness Flat Turret Lathe."

Springfield, Vt., U.S.A., and 97 Queen Victoria St., London, England.

Germany, Holland, Belgium, Switzerland and Austria-Hungary: M. Koyemann, Charlottenstrasse, 112, Düsseldorf, Germany. France and Spain: Ph. Bonvillain and E. Ronceray, 9 and 11, Rue des Envierges, Paris, France. Italy: Adler & Eisenschitz, Milan.

LIST PRICE
$100.00

THIS cut represents our No. 5 Screw Cutting Lathe. Swings 11 inches on face plate, 34 inches and 40 inches between centers; has swivel tool carriage and is adapted to taper turning and boring. Compound rest and raising blocks extra. Stand-up treadle or countershaft if desired. **List Price $100.00.**

LIST PRICE
$75.00

OUR No. 4½ Lathe is identical in construction with the No. 5 Lathe, except of smaller dimensions. It swings 9 inches over face plate and 25 inches between centers. Has set-over tailstock, swivel tool carriage for taper boring and turning. For experimental, electrical and repair work this tool is unsurpassed. Countershaft or stand-up treadle power furnished if desired.

Our No. 5½ Lathe swings 13 inches over face plate and is made in different length beds up to 10 feet long.

Our No. 13 Lathe swings 13 inches over face plate and has automatic cross-feed and compound rest; made in different length beds up to 10 feet long.

SEND FOR CATALOG

TRADE W.F. J.B. MARK

W. F. & JOHN BARNES CO.,

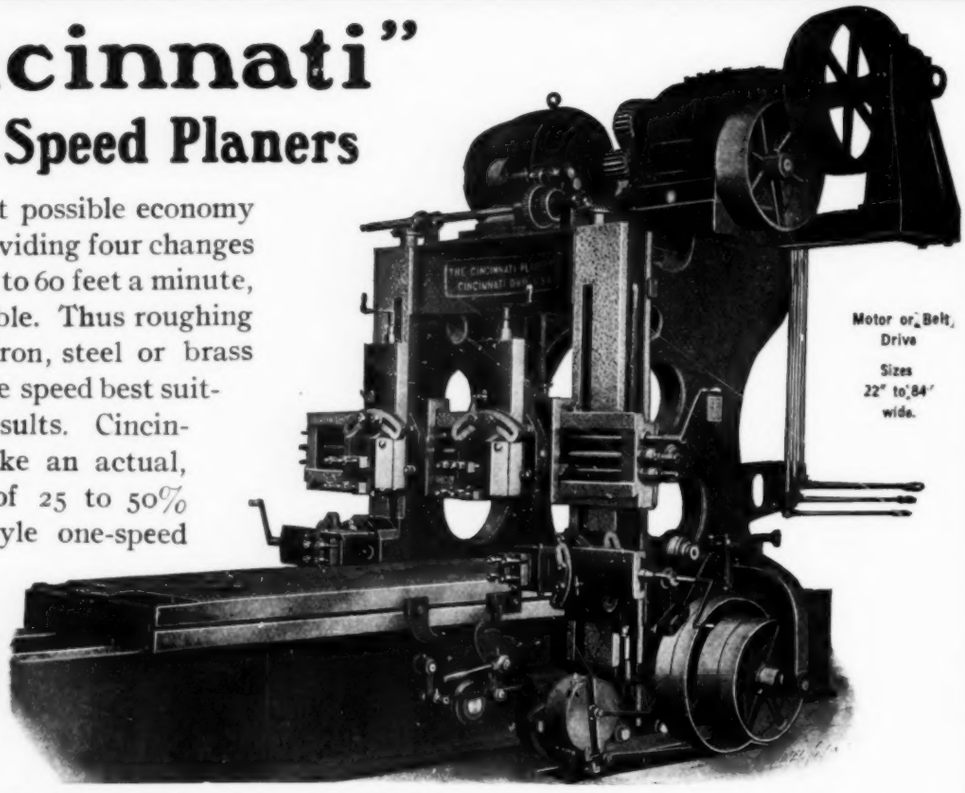
England by Chas. Churchill & Co., London.

1995 Ruby St., ESTABLISHED 1872. ROCKFORD, ILL., U.S.A.

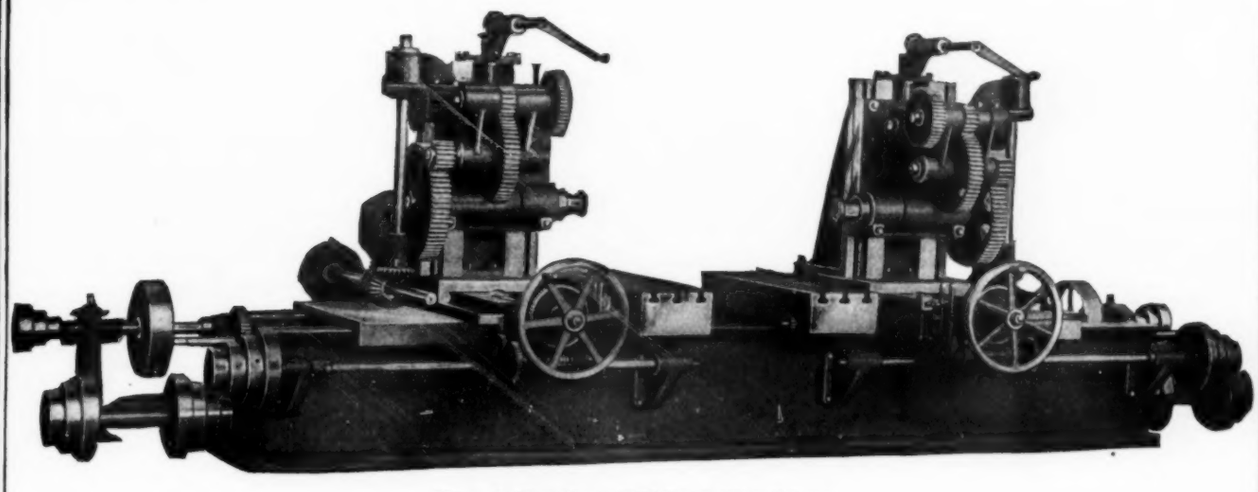
"Cincinnati"
Variable Speed Planers

obtain the highest possible economy in planing by providing four changes of speed, from 15 to 60 feet a minute, instantly obtainable. Thus roughing or finishing cast iron, steel or brass can be done at the speed best suited to get finest results. Cincinnati Planers make an actual, tangible saving of 25 to 50% over the old style one-speed machines.

Write for Descriptive Catalog.



THE CINCINNATI PLANER CO., CINCINNATI, OHIO, U.S.A.



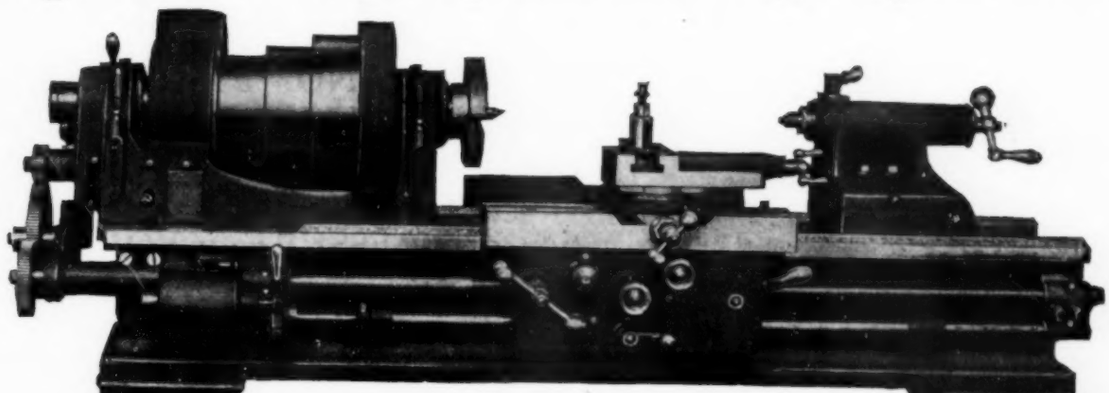
No. 4 Duplex Milling Machine.

This is actually two Milling Machines in one, as the spindles can be driven each independent of the other and operating on its particular piece of work. Again it can be used as one machine, each spindle taking a cut on the same piece. The work remains stationary and the ends of a long piece are finished parallel.

THE BEAMAN & SMITH CO., Providence, R. I., U. S. A.

England: Chas. Churchill & Co., London. France: Fenwick Freres & Co., Paris. Germany: Ludw. Loewe & Co., Berlin.

The Lathe for High Speeds and High Speed Steels



Our New Standard Engine Lathe with 3-Step Cone and Double Back Gears here shown.

It gives *eight more speeds* than the usual 5-Step Cone, having a range of 18 spindle speeds. *Twice the power.* Sizes 14", 16" and 18". For light or heavy work, it is an out-of-the-common result producer worth looking up. *Send for Circular* 126.

The Springfield Machine Tool Co.

Springfield, Ohio, U. S. A.

Ing. Vaghi Accornero & Co., Agents for Italy.
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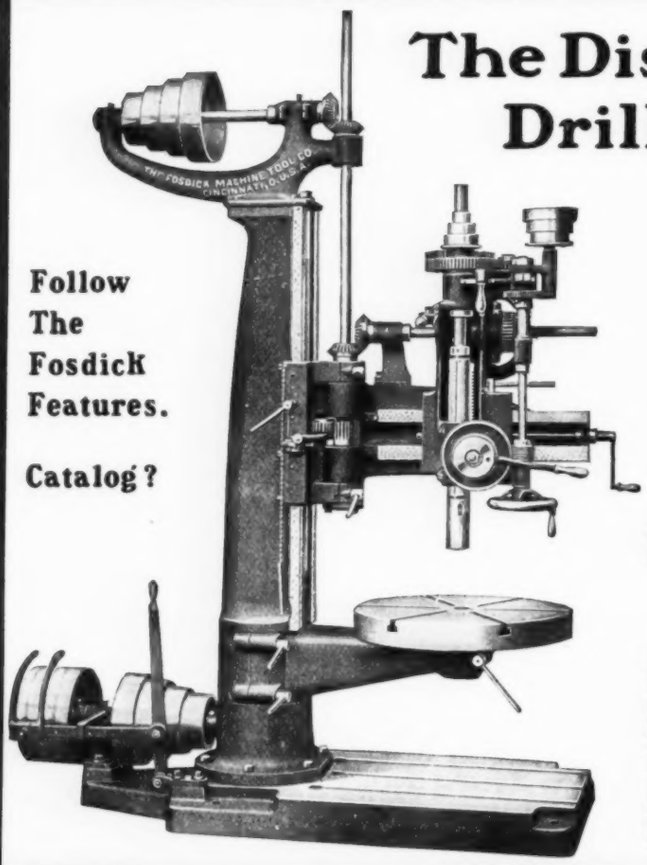
The Distinctly Different Drill



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The Fosdick Radial Drill has improvements that enable it to save more time, labor and money than any other in existence. It cuts cost of hole production to lowest possible point and soon pays for itself in any shop.

Made in all sizes from 2 ft. to 8 ft. arms.

Learn all the details.

The Fosdick Machine Tool Co.

Cincinnati, Ohio, U. S. A.

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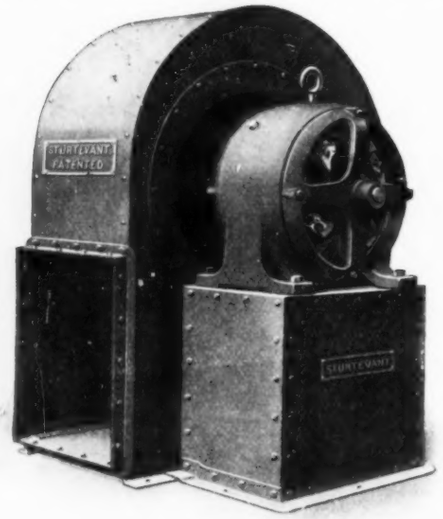

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If your fan is driven by a STURTEVANT Motor or Engine the set is the best you can buy.

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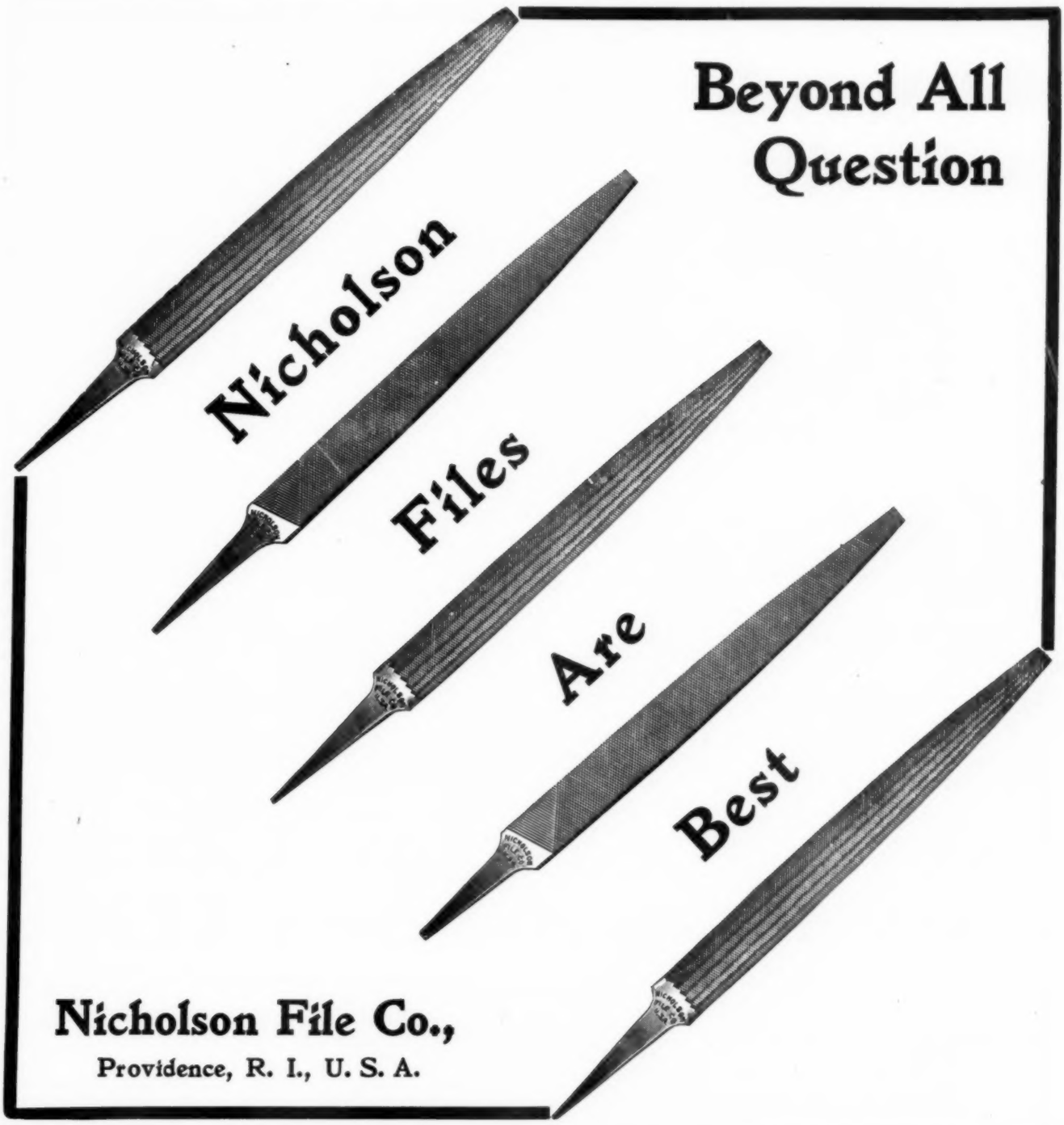

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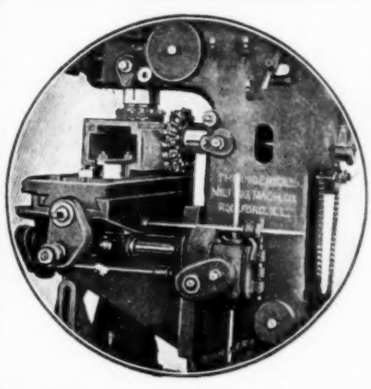

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It Is Very Simple

THERE are no intricate parts to a Crosby Indicator that must be finely adjusted before a card can be taken. It is always accurate and ready. We also furnish Reducing Wheel for the same.

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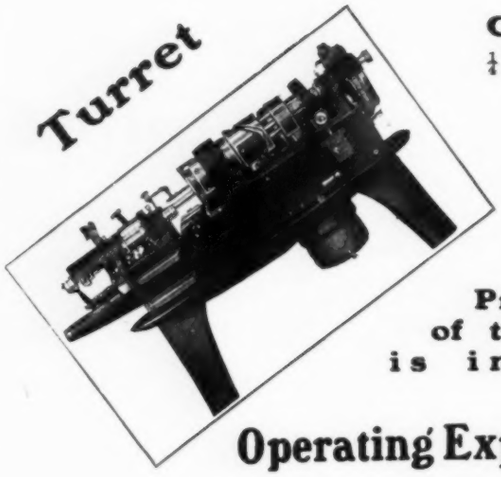

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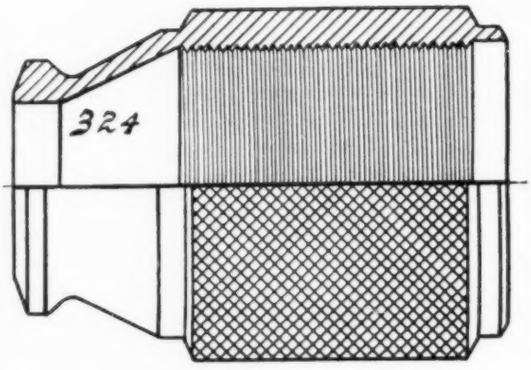

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Piece No. 324. Material, Machine Steel Bar, made on a 2" Cleveland Automatic Turret Machine; drawing full size; *output per hour*, 6; this means all operations for completing this piece; actual cost of labor for each piece, 1 *cent*.

Send in samples or drawings; we will send you complete specifications explaining outputs, cost of machines and tools, etc., etc.; *capacities of our machines*, ¼" *to* 6¾".

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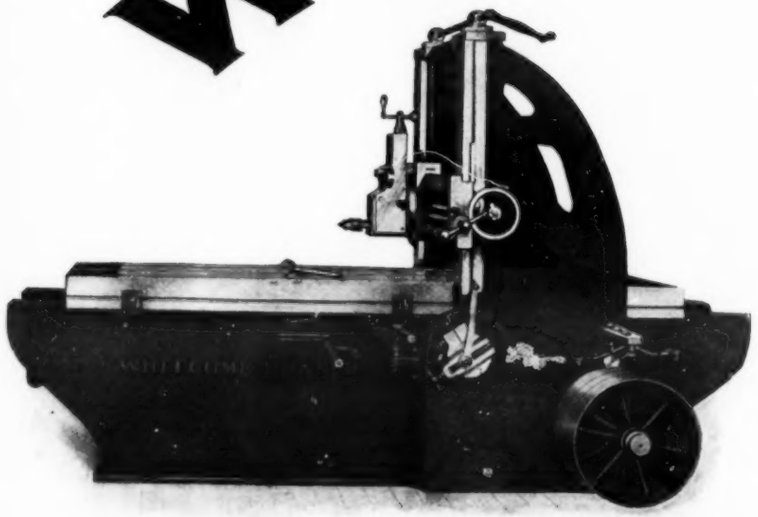
WHITCOMB (W B) BLAISDELL



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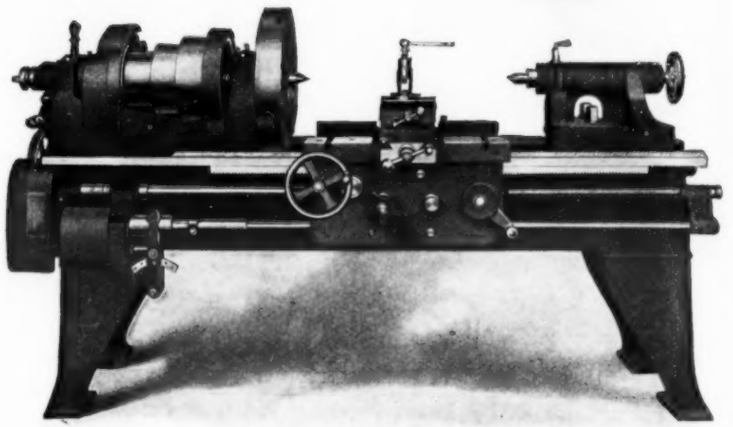

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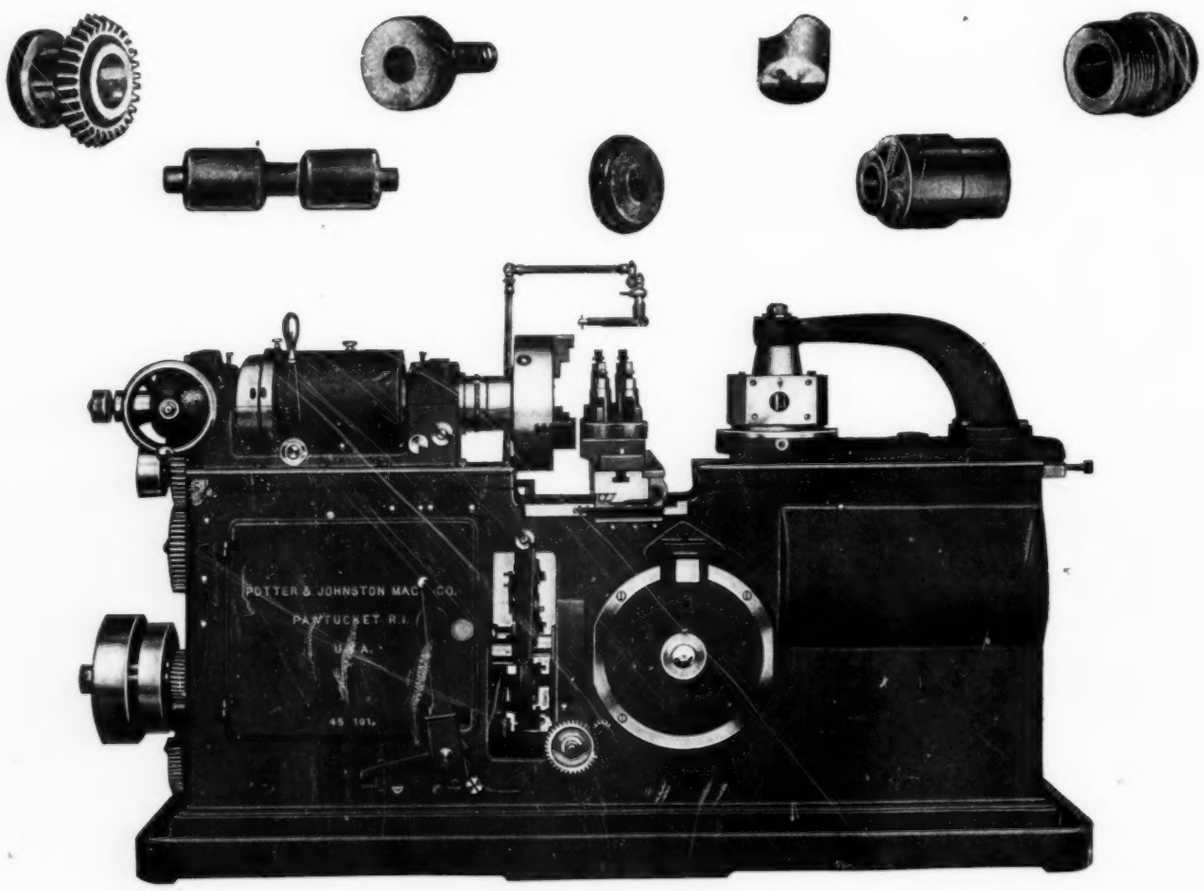

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For the smaller and lighter classes of work.

PRODUCTION ESTIMATES CHEERFULLY FURNISHED.

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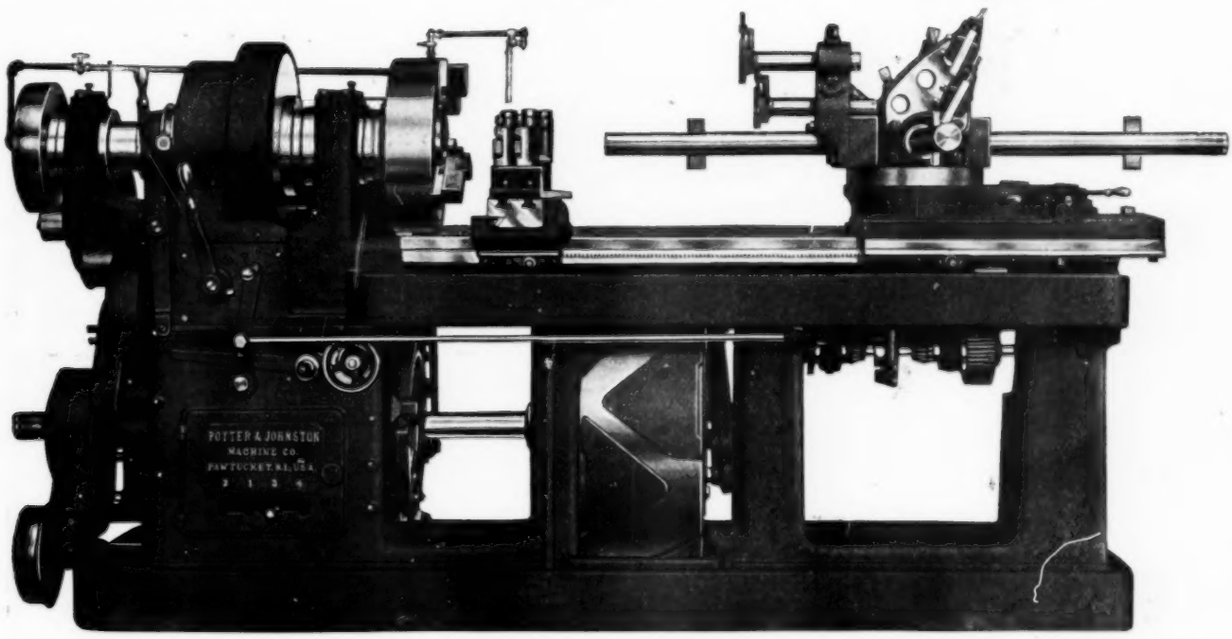
Suited to every service.



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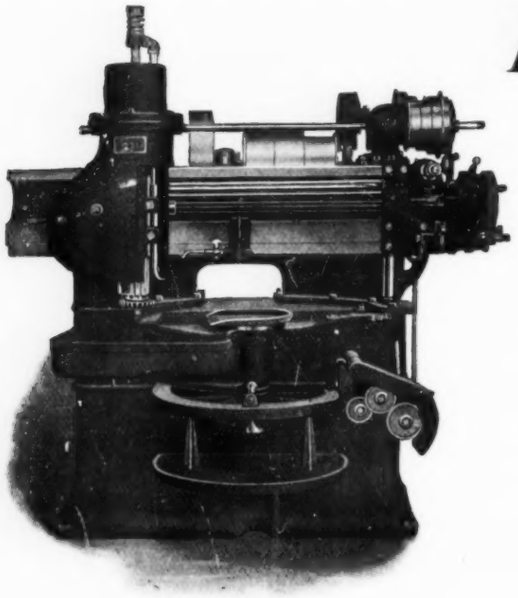

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No unground cutter will be good enough for '09 gears. The best is none too good, and the best in '09, as heretofore and always, will be the Gear Shaper generating cutter. The Gear Shaper would keep down the cost of your gears by cutting them 25 to 50% faster than any other machine. The reason is explained in our literature.

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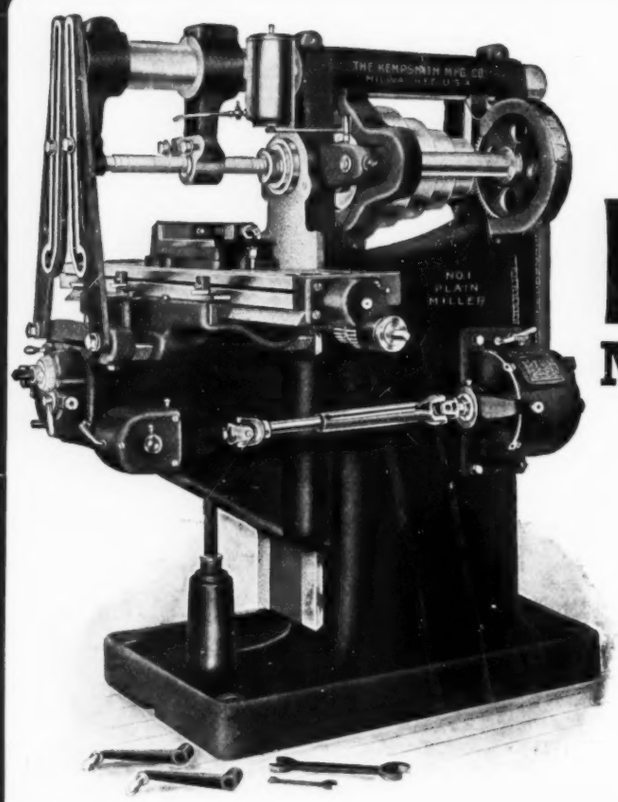

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KEMPSMITH

MILLING MACHINES

In every point which determines what the machine will do (efficiency of entire automatic feeding and operative mechanism, weight, belt power, range of feeds, accuracy of construction, etc.) these machines have distinct advantages, and we can prove it.

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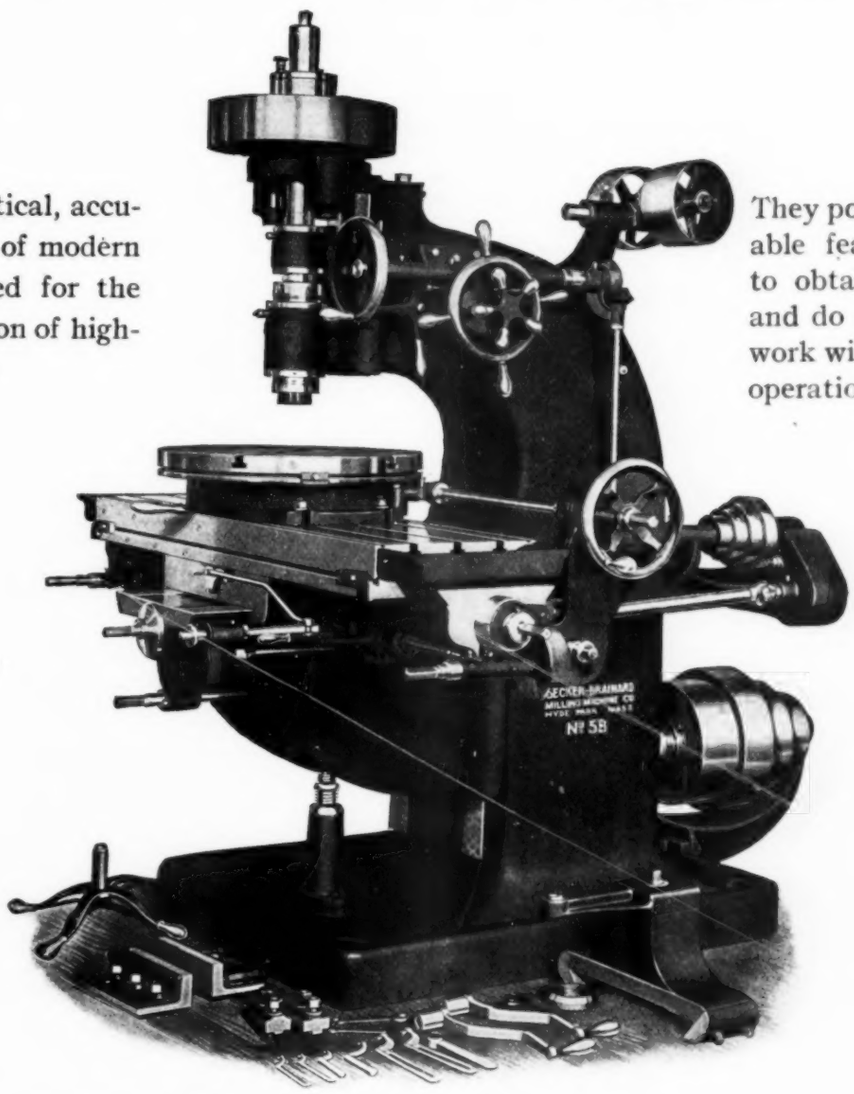
For All Manufacturing Purposes

They are practical, accurate machines of modern design intended for the rapid production of highly exact work.



They possess all the valuable features that help to obtain larger output and do a wider range of work with greater ease of operation.

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Upright Drilling and Tapping Machine, with its unique Patent Geared Tapping Attachment. This Drill is guaranteed the leader in the production of absolutely accurate work at minimum cost. It has the exactly right positive feeds for drilling tool and machinery steel, cast and wrought iron, and for boring, reaming and tapping.

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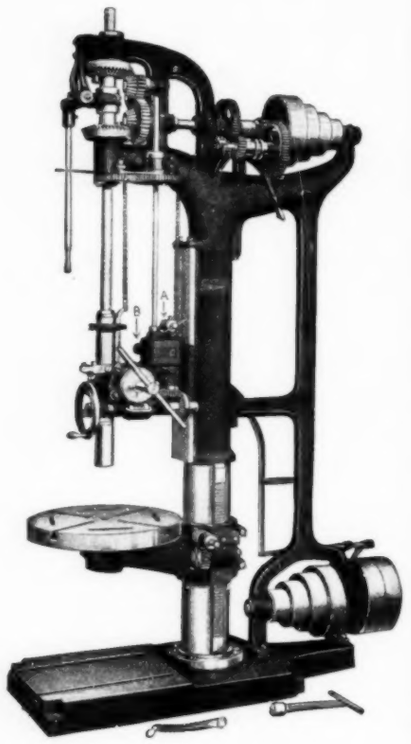

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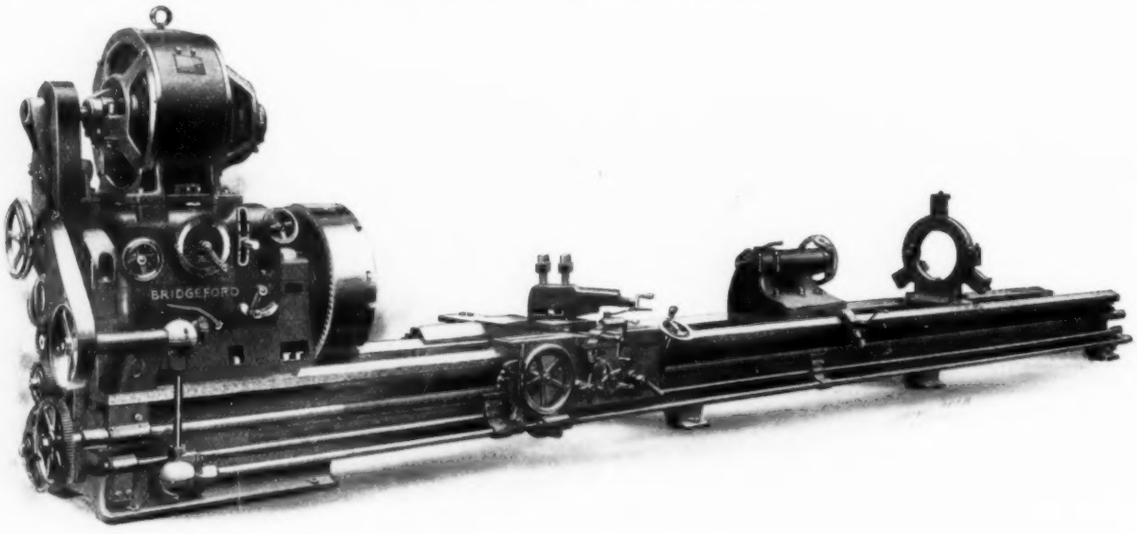

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Ordinary taps lose their initial efficiency in a short time and soon cut untrue threads. Ordinary taps break easily. Ordinary taps are a constant expense and trouble.

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cut fast and true at the start and keep on that way long after others are in the scrap heap. Card Taps do *not* break easily. They are made of the finest steel tempered just right.

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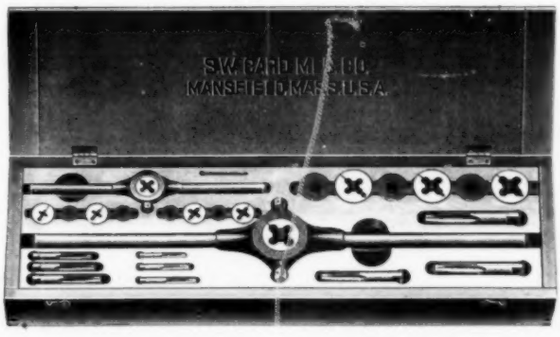

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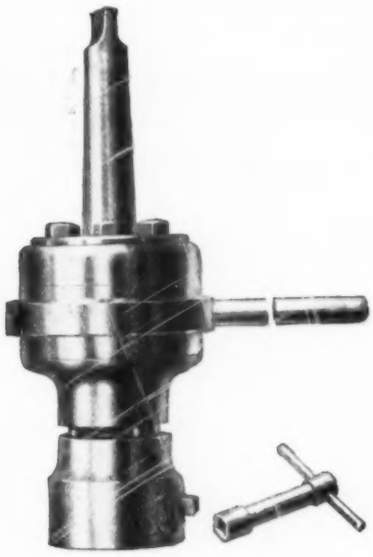

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will you need a Reversing Belt, if you use the GEOMETRIC REVERSING TAP HOLDER.

Never again will you kick at the number of broken taps.

The Geometric Holder fits the spindle of any drill press or speed lathe, and for the time being, converts it into an excellent tapping machine. Reverse is automatic, and accelerated return speed is three times that of cutting.

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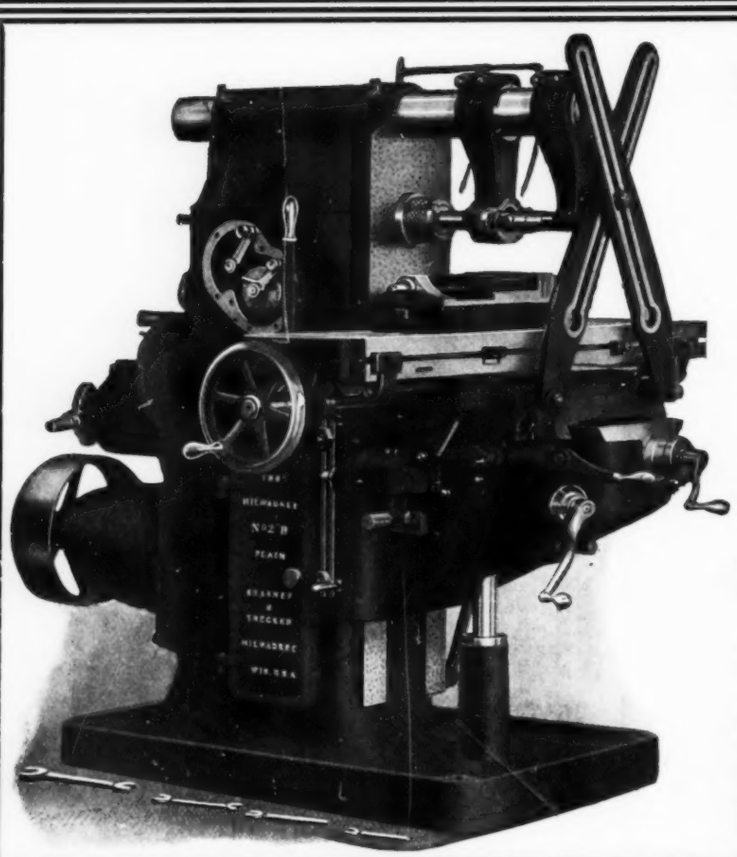

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The oiling question is important in high speed, heavy service—it is successfully met in "MILWAUKEE" MILLERS. Learn the other important details. Write us.

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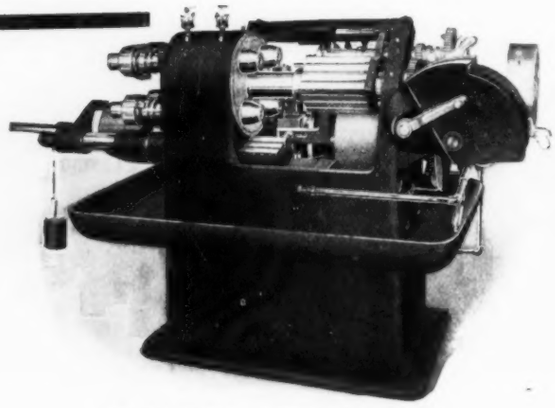
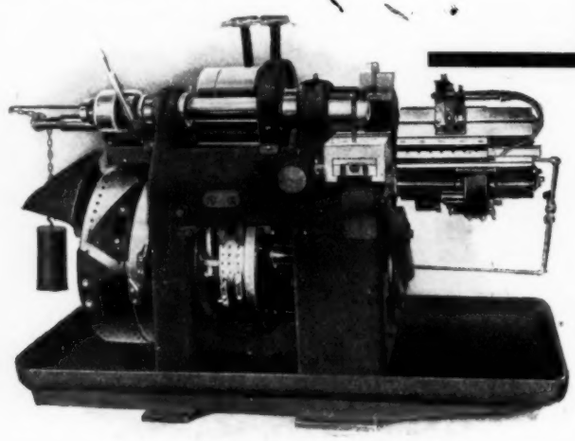
Their Range is greater, they are more Rapid and they have far more Rigid Tool Control than other automatics. The catalog shows how they get more accurate results. Send for a copy. Made in two types as shown below.



Multiple Spindle Automatic—4 Spindle



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Windsor Machine Co., Windsor, Vt., U. S. A.

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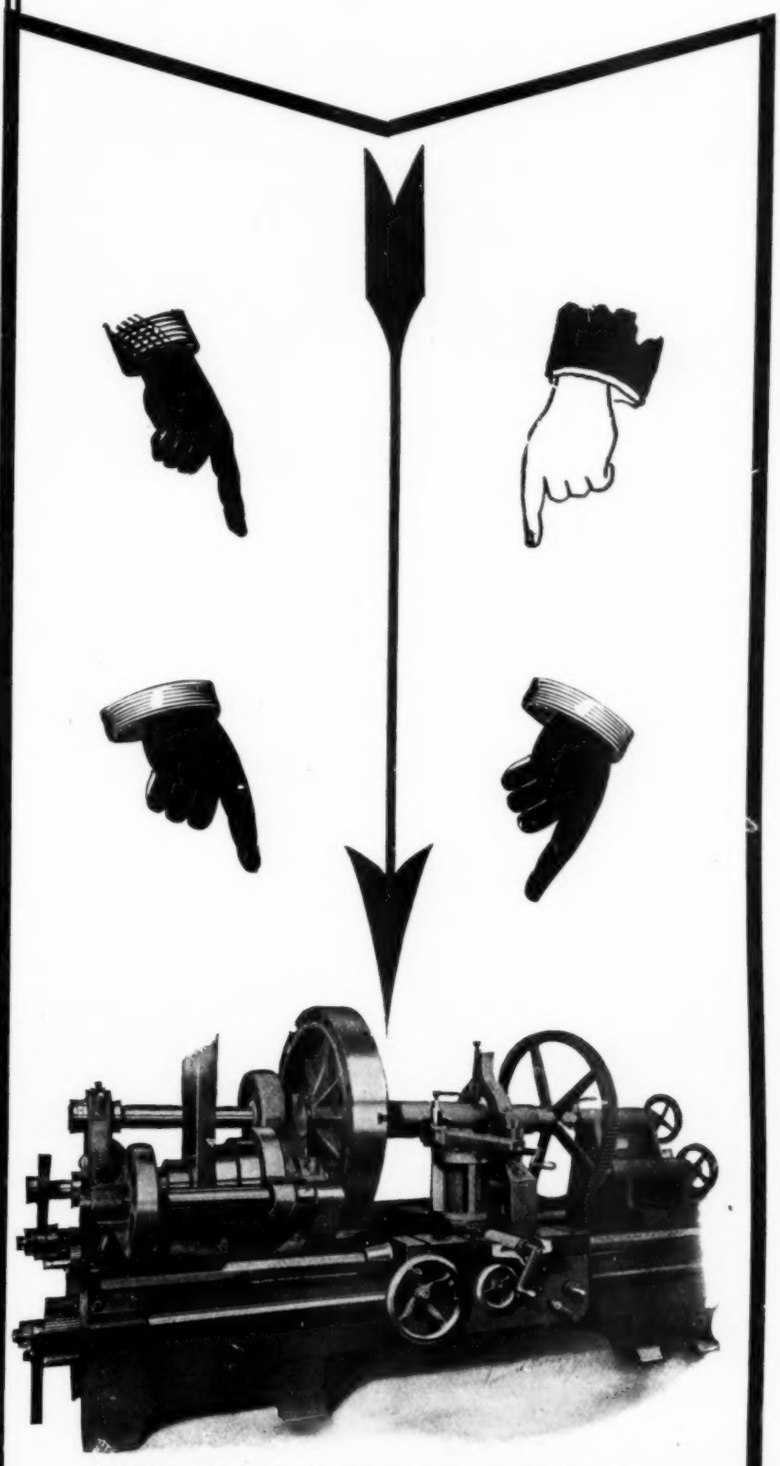

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Double Spindle Lathe as the greatest Lathe in existence f r Repair Shops, Manufacturing Shops, Machine Shops and Tool Shops.

Its ability to take in every Lathe-job that comes along, and thus keep running constantly.

Its faculty of being used either as a 26-inch Back geared, or a 48-inch Triple-geared, on both light and heavy work.

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Its ability to turn full distance between centers on both Lathes.

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Its marvelous accuracy, conveniences, workmanship and finish, which rival the standard found in the very expensive tools.

You'll find the other "points" in our Catalog—it's an "odd fellow."

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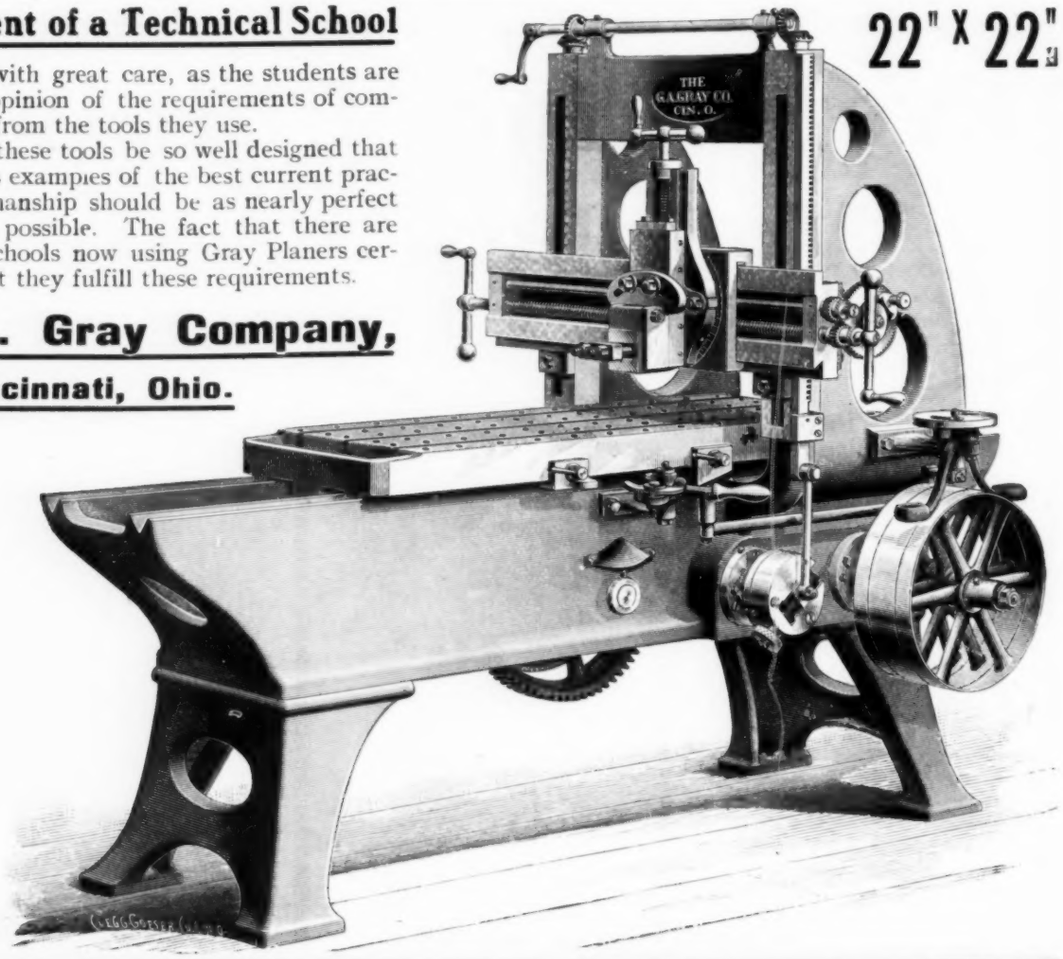
should be selected with great care, as the students are apt to form their opinion of the requirements of commerical shop work from the tools they use.

Not only should these tools be so well designed that they can be used as exampies of the best current practice; but the workmanship should be as nearly perfect as is commercially possible. The fact that there are over 60 technical schools now using Gray Planers certainly indicates that they fulfill these requirements.

The G. A. Gray Company,

Cincinnati, Ohio.



They Can Imitate the Pattern But They Can't Duplicate the Quality

The man who allows a dealer to sell him a "Coes Pattern" wrench is getting a true "Coes" no more than if he purchased a foot of gas pipe. The Coes "Genuine" Wrench is sold under the name "COES" without strings or tags to confuse or mislead. Remember this the next time someone says, "Here's a just-as-good."

COES Knife-Handle Model

is from 10 to 15 per cent. stronger than any substitute or imitation. The handle will not split apart, it is secured at both ends by insertion under metal and riveted up under pressure. The screw is steel, *one piece* and hardened. The jaw is a semi-steel casting, hardened. Write for "Wrench Book."

Coes Wrench Co., Worcester, Mass.

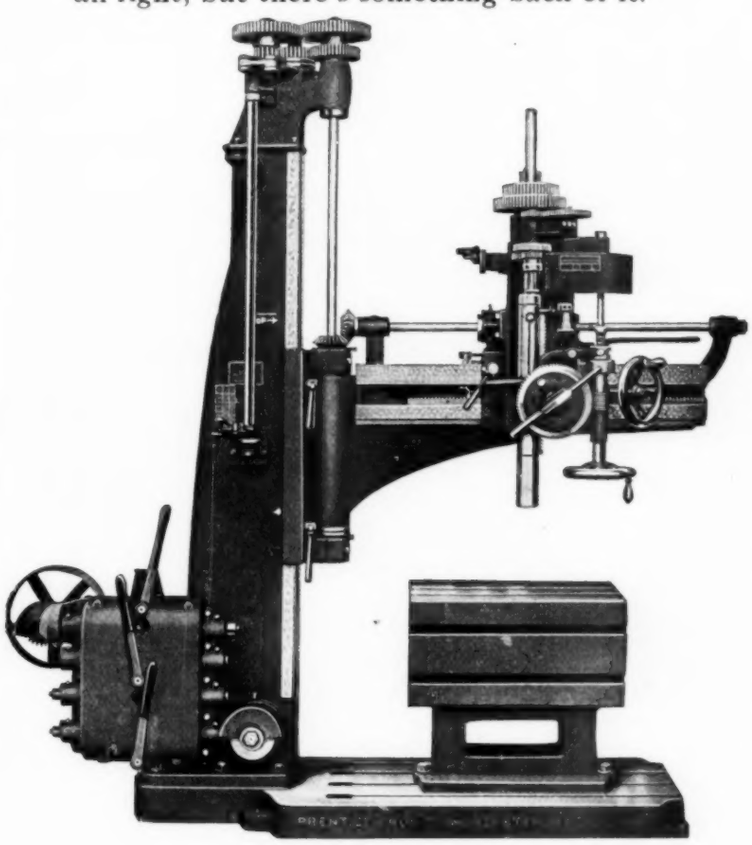
AGENTS—J. C. McCarty & Co., 21 Murray St., New York. John H. Graham & Co., 113 Chambers St., New York. Or your dealer.

Half A Minute Saved On Each Hole

There's our claim—take it or leave it.

Of course it's a big one—bigger than any other drill on the market could make, but then you must remember that the Prentice Radial Drill is a bigger, broader and better proposition than any drill ever constructed.

Some people think there's a string to our claim. They say, "That sounds all right, but there's something back of it."



Now see here! We're taking a solid page in this paper because we hope to get your order. *We wouldn't dare* mislead you. If we did, we'd get your ill-will, the news would spread, we'd be branded as "tricksters," and have to erect a monument in memorium to our lost reputation.

That our drill saves 20 to 30 seconds on each hole, is a *positive fact*—as hundreds of shops can testify.

With PROSPERITY here with a vengeance, think what this half-a-minute saving means to you.

Write for full particulars.

Prentice Bros. Co., Worcester, Mass., U.S.A.

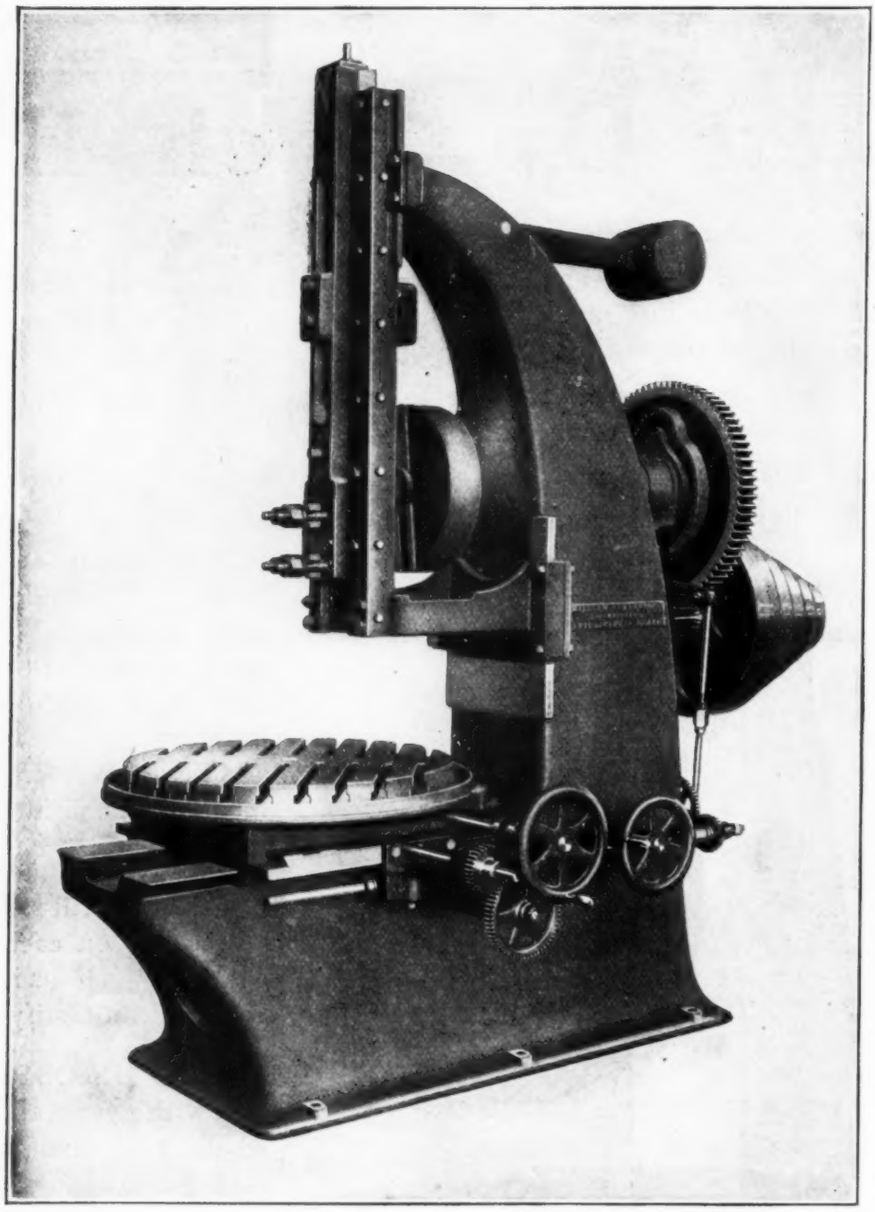
Builders of Radial and Upright Drilling Machines, Engine and Turret Lathes

AGENTS—The Fairbanks Company, New York, Albany, Boston, Philadelphia, Syracuse, Hartford, New Orleans. The Strong, Carlisle & Hammond Co., Cleveland and Detroit. The Chas. G. Smith Company, Pittsburgh. The O. L. Packard Machinery Company, Chicago and Milwaukee. The Marshall & Huschart Machinery Co., St. Louis. Alfred H. Schutte, Cologne, Paris, Bilbao, Milan, Brussels and Liege. Schuchardt & Schutte, Berlin, Vienna, Stockholm, St. Petersburg, Copenhagen, Budapest and London.

William Sellers & Co., Incorp.

PHILADELPHIA, PA.

LABOR SAVING



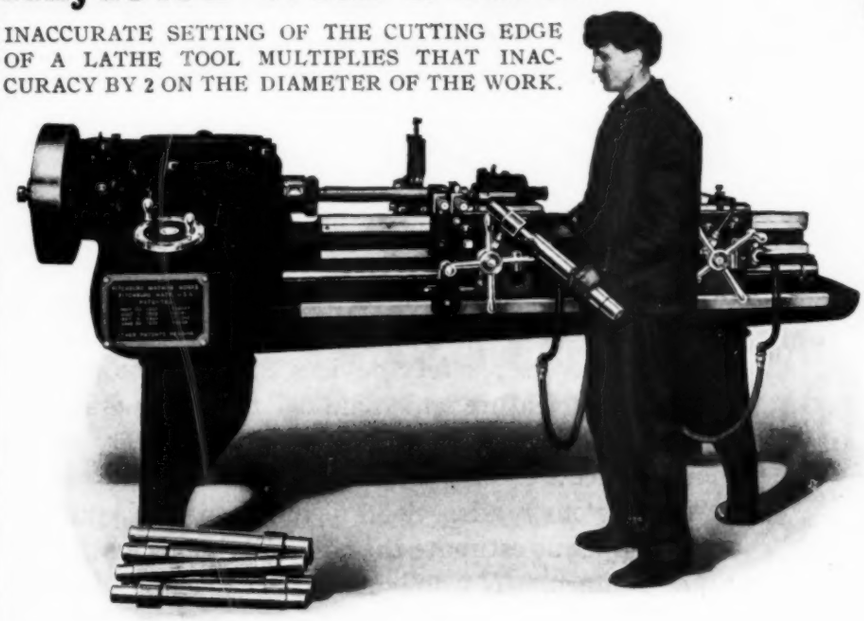
MACHINE TOOLS

In our SLOTTING MACHINES a purchaser secures a tool that will earn an unusually large dividend; a tool that embodies the most valuable features required in such a machine, viz: stability, accuracy and convenience of manipulation; a tool that will produce the largest and best product in a given time.

Cranes Shafting Injectors Turntables Etc.

The Lo-Swing Lathe Tools are Adjusted With a Screw

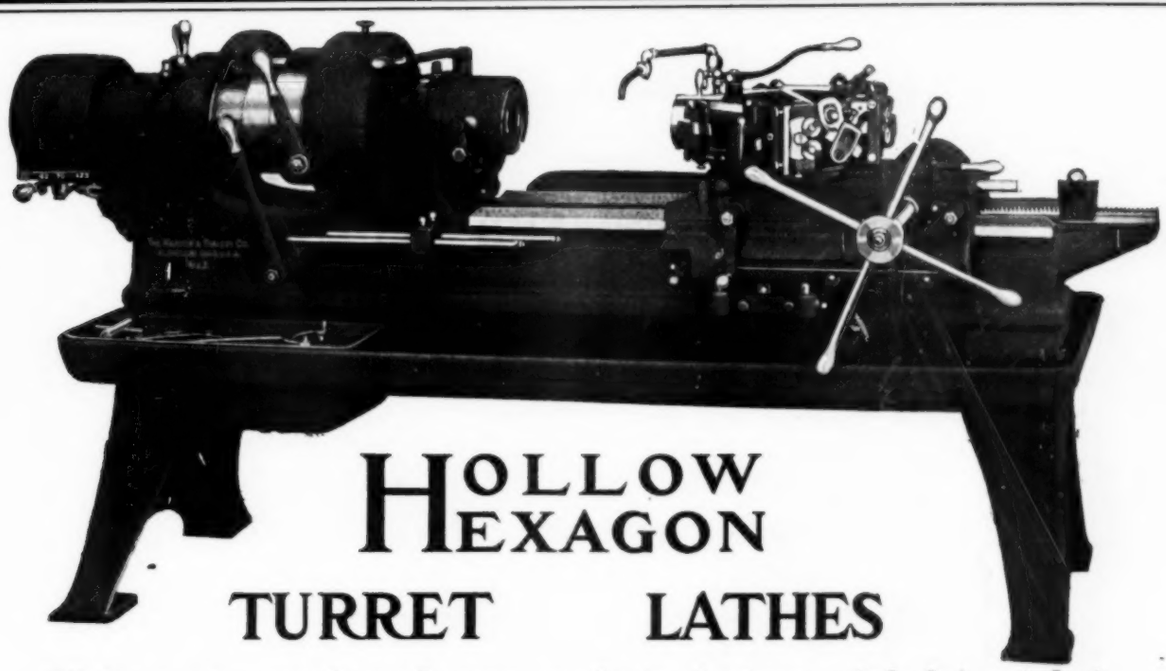
INACCURATE SETTING OF THE CUTTING EDGE OF A LATHE TOOL MULTIPLIES THAT INACCURACY BY 2 ON THE DIAMETER OF THE WORK.



There is no great skill required in setting the tools of a Lo-Swing whose limited range and general make-up gives greater stiffness than could be possible on other forms of lathes. From 1 to 6 tools working at one time against roller thrust bearings.

FITCHBURG MACHINE WORKS, FITCHBURG, MASS., U. S. A.

FOREIGN AGENTS—P. & W. Maclellen, Ltd., Glasgow. Henry Kelley & Co., Manchester. Alfred H. Schutte, Paris, Bilbao, Barcelona. M. Koyemann, Dusseldorf, (for Germany, Belgium, Holland, Switzerland). Schuchardt & Schutte, Vienna. Adler & Eisenschitz, Milan.



HOLLOW HEXAGON TURRET LATHES

Wide range, rapid producers, made in 4 sizes. Ask for catalog.

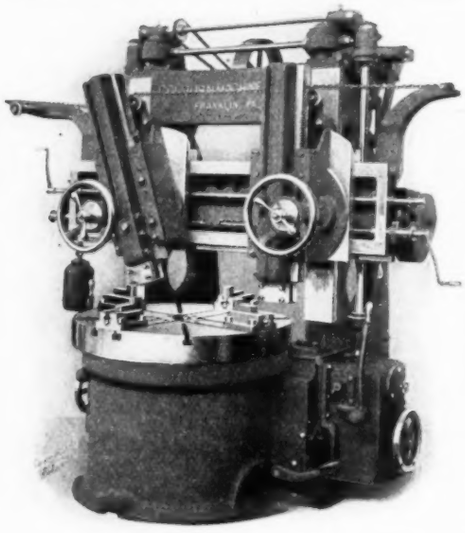
THE WARNER & SWASEY COMPANY, Cleveland, Ohio.

TURRET LATHES, SCREW MACHINES, BRASS WORKING MACHINE TOOLS.

New York Office—Singer Building, 149 Broadway. **Chicago Office**—Commercial National Bank Building.

FOREIGN AGENTS—Chas. Churchill & Co., London, Birmingham, Manchester, Newcastle-on-Tyne and Glasgow. Schuchardt & Schutte, Berlin, Vienna, St. Petersburg, Stockholm, Copenhagen and Budapest. Alfred H. Schutte, Cologne, Paris, Brussels, Liege, Milan, Madrid, Bilbao and Barcelona. A. R. Williams & Co., Toronto. Williams & Wilson, Montreal.

COLBURN BORING MILLS



Eat up the work.

They establish new records wherever installed.

They meet the most exacting demands for mills of large productive capacity.

No other mill so thoroughly represents in every detail the many modern ideas in boring mill design and construction.

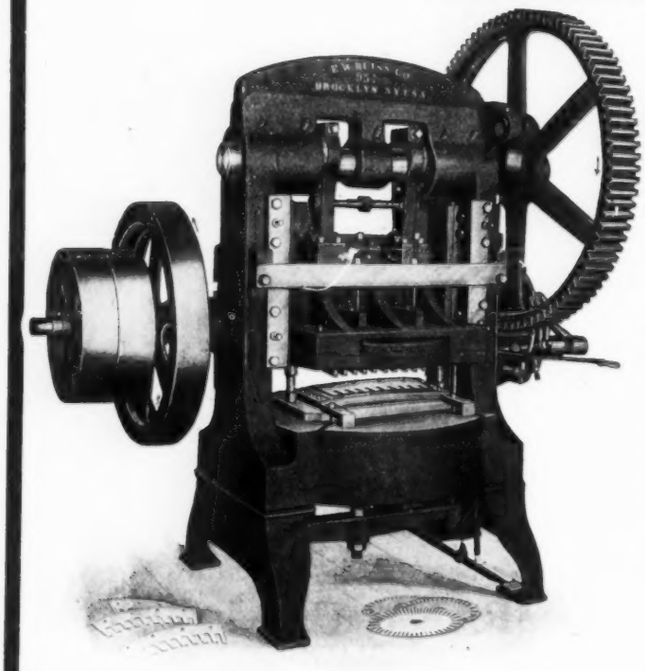
Rapid traverse, safety devices, stiffness, power, in fact every feature which aids in the production of work rapidly, economically and accurately is incorporated.

Tell us your needs. Send us blue prints of your work and let us estimate the cost of doing it on the rapid Colburn. No obligation whatever on your part. SIZES 30″, 34″, 42″, 48″, 53″, 60″ and 72″.

COLBURN MACHINE TOOL COMPANY, Franklin, Pa., U. S. A.

FOREIGN AGENTS: Ludw. Loewe & Co., Berlin and London.

"BLISS"



Armature Disk Cutting Press, Geared. No. 95¾

ARMATURE DISK AND SEGMENT CUTTING PRESSES

These presses are specially designed for rapidly and accurately punching armature disks and segments for motors and generators. They have positive top and bottom knockouts. The slides are guided in ways of exceptional length and width, so as to carry the very expensive tools with perfect accuracy.

We build circle shears specially designed for cutting inside and outside diameters of armature disks, or when fitted with segment-cutting attachment, for cutting segments. Armature disk and segment notching machines, smoothing rolls, etc. Economy, speed and convenience are special features of all our line. Write us stating your needs. We build

"PRESSES FOR EVERY PURPOSE"

E. W. BLISS CO.

1 ADAMS STREET, BROOKLYN, N. Y., U. S. A.

European office: 100 Boulevard Victor Hugo, St. Ouen (Paris), France.

London office: 114 Queen Victoria St., London, E. C., England.

GRINDING WHEEL EFFICIENCY

The efficiency of a grinding wheel depends upon its adaptability to the work for which it is intended—
It has got to be the right size and shape—the right degree of hardness—the right "grit."
When these conditions are right, then if you have the right *kind* of a wheel your grinding department will show its highest possible efficiency.

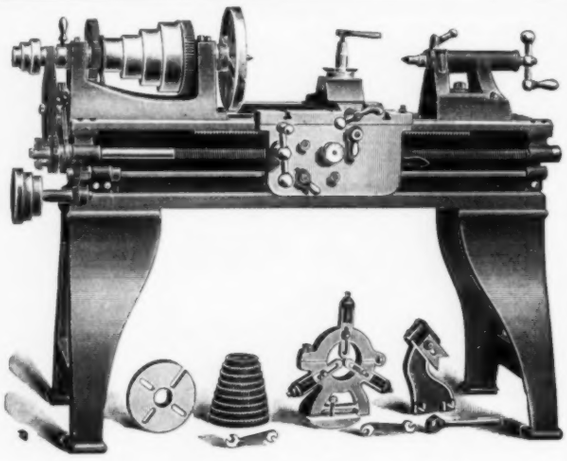
CARBORUNDUM

is the right *kind* of a wheel—no matter what the work is there is no doubt on that point.
Carborundum is the most efficient grinding material the world has ever known—
It is hard and sharp and long lasting.
It doesn't gum up and require frequent dressing—
It doesn't heat the work or draw temper from fine steel—
But—it is necessary to have the right Carborundum wheel for the particular work you have to do—
That is where we can help you—
We have grinding wheel experts whose duty it is to help you get the highest possible efficiency from your grinding department.

Write them your grinding troubles.

THE CARBORUNDUM COMPANY
NIAGARA FALLS, N. Y.
29 CLIFTON STREET, FINSBURY SQUARE, LONDON, E. C.

CARBORUNDUM
NIAGARA FALLS



"What Shall I Do?"

asked a man who was using his big lathe to turn his small and medium work. "I'm wasting time making adjustments, wasting power and keeping my big lathe off its regular work. I wish a good small lathe wasn't so expensive."

"It isn't," replied his friend, "if you get a 15" Sebastian. I was surprised when I got mine to learn its price. It's the best investment I ever made; the best tool in my shop, and built heavy and substantial. Better write and get a catalog."

Sebastian Lathe Company,
117-119 Culvert Street, Cincinnati, Ohio.

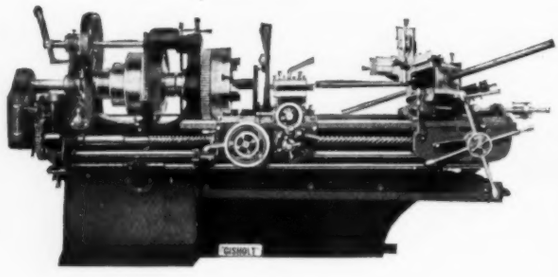
Foreign Agents—C. W. Burton, Griffiths & Co., London; E. Sonnenthal, Jr., Berlin, Cologne, Vienna; Nienstaedt & Co., Copenhagen; Jno. Tragardth & Co., Gothenburg; A. Baldini & Co., Pontedera, Italy; F. W. Horne, Yokohoma.

HIGLEY

Metal Saws in 16 Sizes

THE ORIGINAL SPROCKET DRIVEN MACHINE
OVER 2000 IN USE

VANDYCK CHURCHILL COMPANY
New York Pittsburgh
New Haven Philadelphia



Gisholt Lathes

FOR 20 YEARS THE RECOGNIZED STANDARD.

Our knowledge of turret lathes and their output has been gained from many sources, and extends to practically every kind of work that can be produced on such a machine.

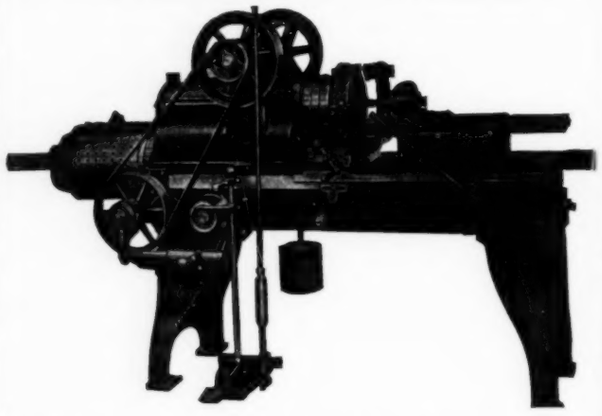
Put your problems before us, and profit by our years of experience.

We also manufacture a line of Vertical Boring Mills, 30" and up, which are strictly labor saving tools, were designed after very careful study and marketed after thorough testing out, with remarkable success.

Gisholt Machine Company,

Works: Madison, Wis. Warren, Pa.

Gen'l Offices: 1315 Washington Ave., Madison, Wis.



The Fay Is The Only Automatic Lathe That Holds The Work Between Centers

Once the work is placed all operations for finishing are done entirely automatically and one man can easily attend to from 4 to 6 machines.

This lathe is in a class by itself for machining castings; forgings, etc. Send us blue prints and we'll give you production estimates.

The Fay Machine Tool Co.,
Glenwood Avenue and 2d Street,
PHILADELPHIA.

60-tonand 40-ton Niles Cranes, 75 ft. span and two ten-ton, 3 Motor Niles Wall Cranes, 25 ft. arms. Reading Iron Co., Reading, Pa.

Niles Cranes

2 to 200 Tons Capacity

Variety of Types shown in our catalogue "Niles Cranes." Write for a copy.

Metal Working Machine Tools

All Kinds and Sizes

Write for Illustrated Catalogues of any machines in which you are interested.

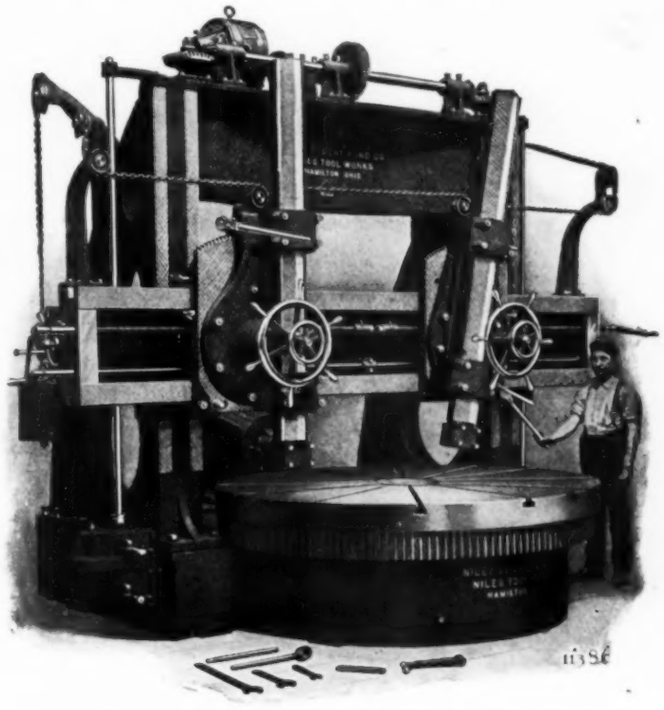
Niles Boring and Turning Mills

Twenty-five sizes from thirty inch to thirty foot swing.

Convertible type—belt driven machines may be readily changed to motor drive at any time.

Regularly built with single pulley or direct connected motor drive through speed box.

Write for Illustrated Catalogue "Niles Boring Mills."



10 ft. Niles Boring and Turning Mill.

NILES-BEMENT-POND COMPANY

Trinity Building, 111 Broadway, New York, U. S. A.

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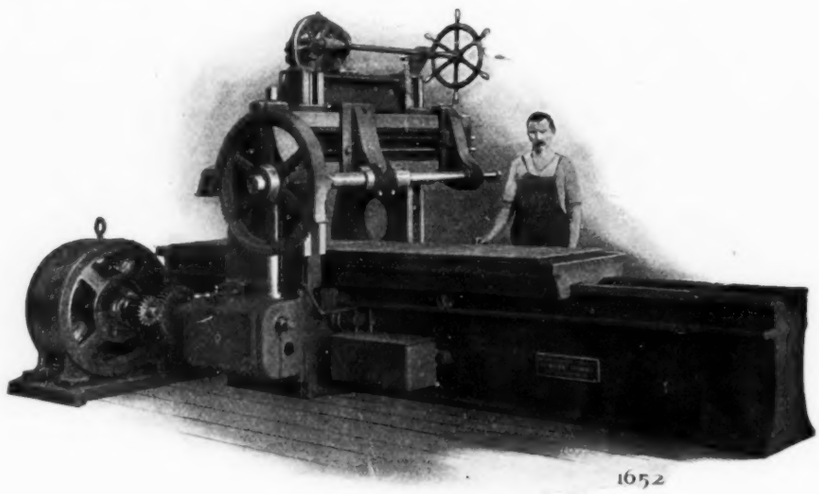
CONTINUOUS HEAVY CUTS

Bement Milling Machines are built in a variety of types and sizes.

They will use the latest improved Milling Cutters, with blades of high power steel, to their limit of endurance.

Write for Catalog "Heavy Milling Machines."



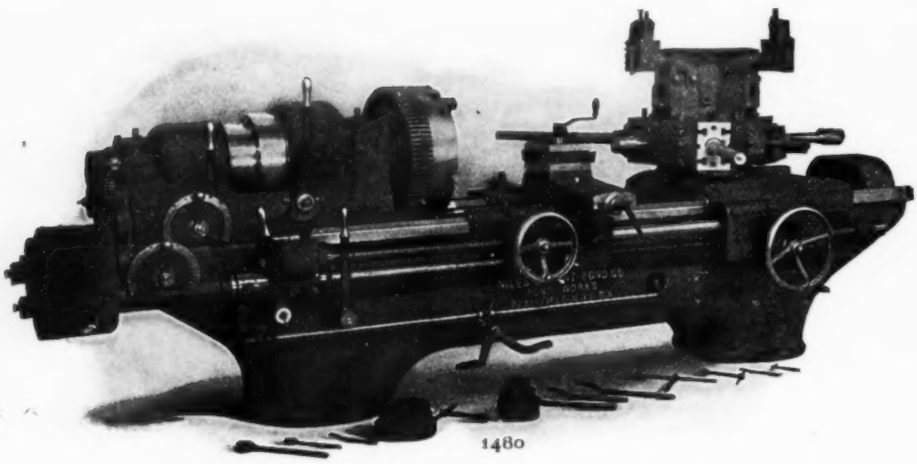
30-Inch Bement Horizontal Milling Machine—Sizes, 24 to 60 inch.

DUPLICATE CHUCK WORK

Pond Rigid Turret Lathe will show 50 to 150 per cent. increase in production on such work as gear blanks, fly wheels, gas engine cylinders, etc.

Tools are of wide adjustment and are rigidly attached to the wide faces of the turret which indexes and clamps automatically and is operated by power.

Write for Catalog "The Pond Rigid Turret Lathe."

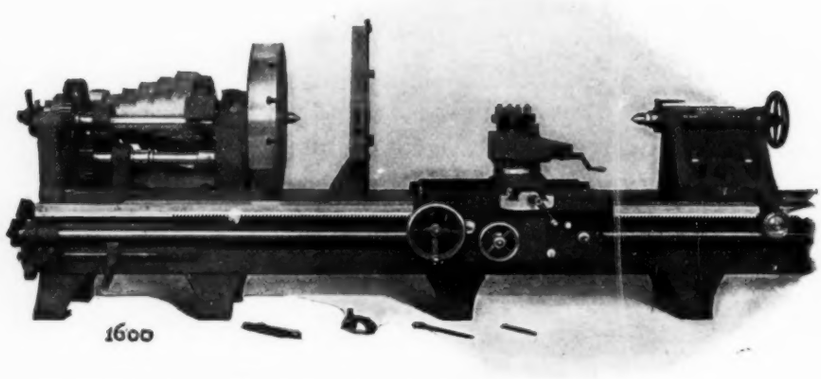


28-Inch Pond Rigid Turret Lathe, also made in 21-Inch.

24 to 72 INCH HEAVY POND LATHES

have long been the standard machines for general shop work. May be furnished belt or motor drive, with quick change gears and a variety of attachments for special work.

Write for Illustrated Circulars "Pond Lathes."



36-Inch Pond Engine Lathe with Quick Change Gears.

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Trinity Building, 111 Broadway, New York, U. S. A.

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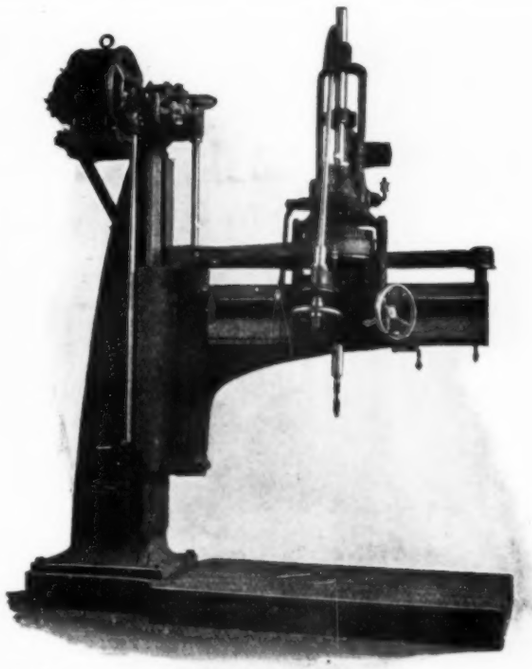
Pond Heavy Radial Drills

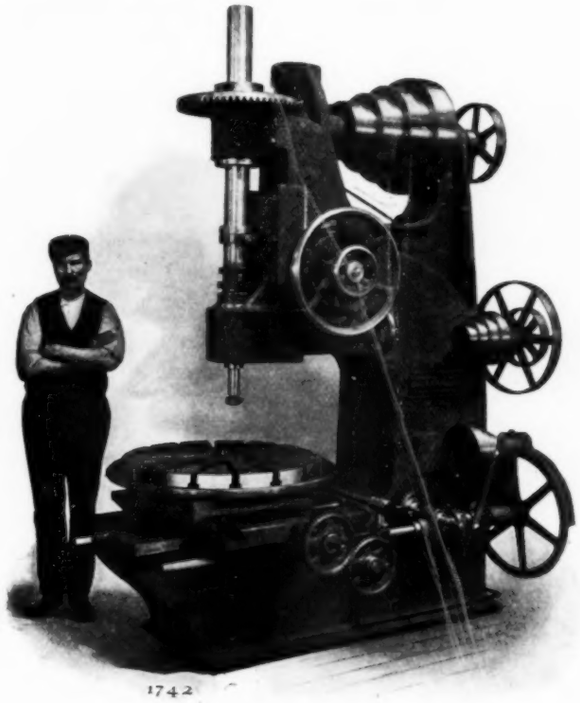
Regularly built in four sizes—five, six, seven and eight foot arms. Direct connected motor drives, five step cone or single pulley through speed box.

A very stiff and powerful machine for all kinds of heavy accurate work.

Easily handled—all levers and handles convenient to operator.



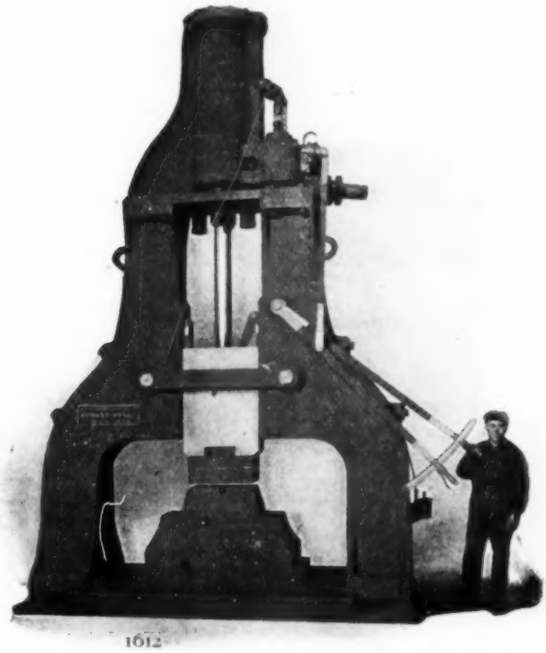
1398



1742

Heavy Milling Machines

Large variety of sizes and combinations of both vertical and horizontal types, which owing to their great capacity are indispensable for certain classes of work.



1612

Bement Steam Hammers

250 to 40,000 lbs. falling weight, variety of types including Single and Double Frame, Single and Double Open Frame, Steam and Board Drop, Steel Tilting, covering all the requirements of modern forge practice.

Write for catalog—"Bement Hammers."

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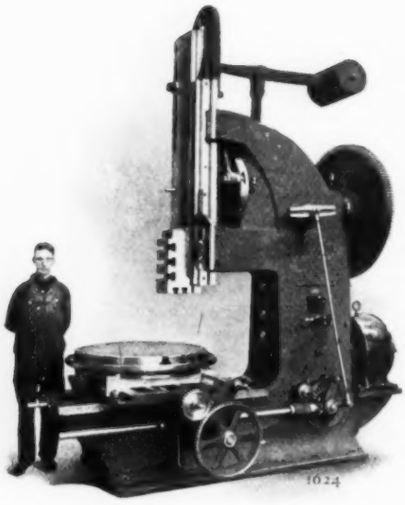
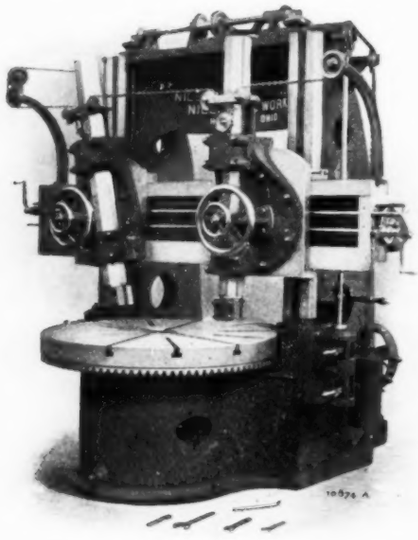
MACHINE TOOLS
ALL KINDS AND SIZES

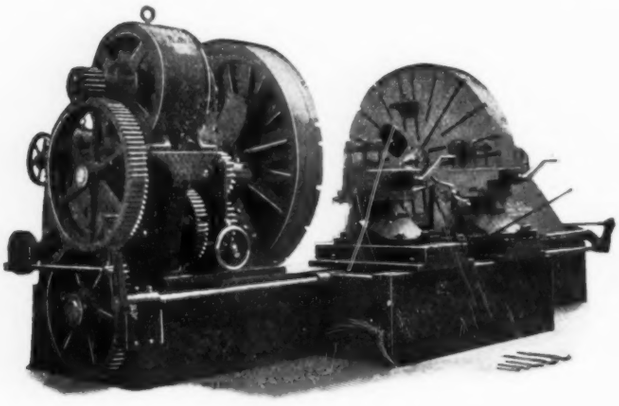


Slotters—6 to 68 in. Stroke

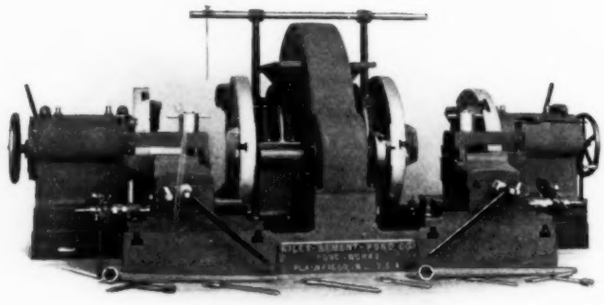


Boring Mills 30 in. to 30 ft. Swing

Vertical Drill Up to 60 in.



Driving Wheel Lathes, 51 to 100 in.



Steel Tired Car Wheel Lathe

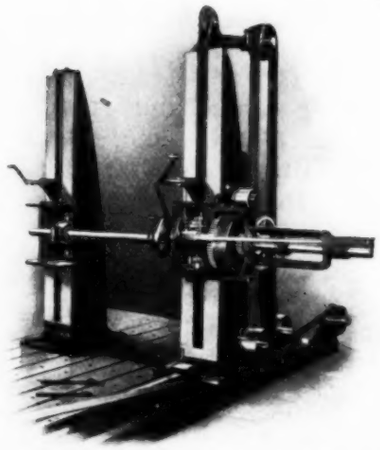
Write for Catalogues

Car Wheel Borers 36 and 48 in.

NILES-BEMENT-POND CO.

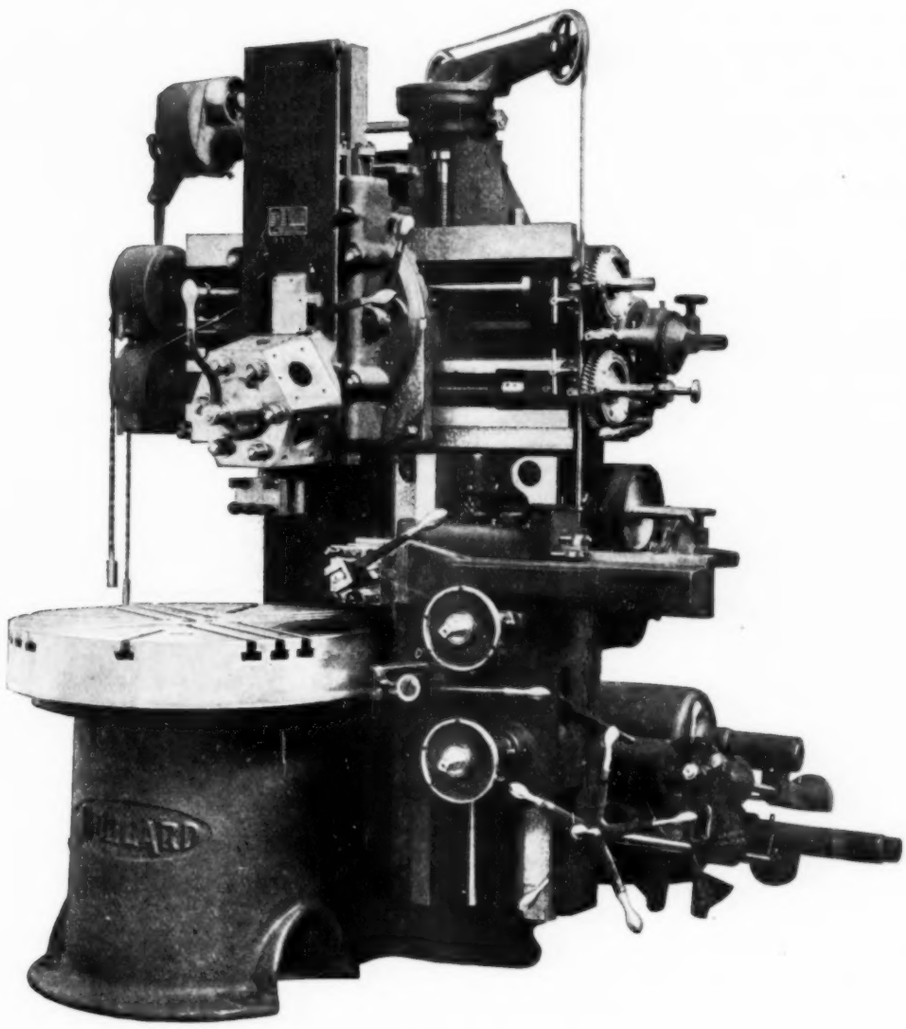
Trinity Building,
111 Broadway,
New York.

For Offices and Agents, see three previous pages.



Horizontal Boring and Drilling Machine

BY taking several cuts at the same time, and by cutting the time between the cuts, the Bullard Vertical Turret Lathe reaches the very limit of rapid production of accurate face plate work. There's no complication about it; the parts are simple; all operation is accomplished from a two-foot circle. Our Catalog No. 30 describes this unique machine in detail. It's worth studying.



The Bullard Machine Tool Co. BRIDGEPORT, CONN., U.S.A.

AGENTS—Marshall & Huschart Machinery Co., Chicago, Ill. The Motch & Merryweather Machinery Co., Cleveland, O. Chas. G. Smith Co., Pittsburg, Pa. C. H. Wood Co., Syracuse, N. Y. Pacific Tool & Supply Co., 556 Howard St., San Francisco, Cal. Williams & Wilson, Montreal, P. Q. A. R. Williams Mchy. Co., Toronto, Ont. Chas. Churchill & Co., Ltd., London, E. C., England. Fenwick Freres & Co., Paris, France. Heinrich Dreyer, Berlin, Germany. Landre & Glinderman, Amsterdam, Holland.

The Flat Turret Lathe Is The Simple Way

For the rapid, accurate production of duplicate bar (or chuck) work the Flat Turret Lathe is in a class by itself. It is the original machine of its type and all its parts are the natural means to the desired end. The control of work and tools is well nigh perfect. Let us give you Flat Turret figures on your work.

See our story on pages 12 and 13.

Jones & Lamson Machine Co.,

Springfield, Vt., U. S. A., and 97 Queen Victoria St., London, England.

DIAMOND TOOLS

For Truing, Dressing and Shaping Emery, Corundum, Carborundum and Alundum Wheels. Set with first quality diamonds and carefully tested before shipment. Security of the special solid setting guaranteed. Write for Catalog and price list.

THOMAS L. DICKINSON, Manufacturer, 64 Nassau Street, New York.
C. W. Burton, Griffiths & Co., London, Sole Agents for Great Britain.

SPECIAL MACHINERY

Designed and Built to order. Inventions developed. Mechanical ideas perfected. References furnished.

JOSEPH MERRITT, Mechanical and Consulting Engineer HARTFORD, CONN.

Black Diamond Files and Rasps

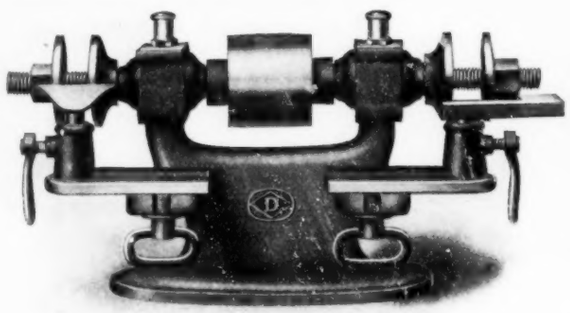
PERFECT ALWAYS

Twelve Medals Awarded at International Expositions

For Sale Everywhere

Copy of Catalog will be sent free to any interested file user on application

G. & H. BARNETT CO., Phila., Pa.



For Tool Grinding, Saw Gumming and Other Light Work

We recommend our

NO. 3 GRINDING MACHINE

It takes wheels up to 10″ diameter, and has 12½″ space between the wheels. If the removable cast iron boxes are replaced as they wear out at long intervals, the life of the machine will extend over many years.

Diamond Machine Company
Providence, R. I.

Vertical and Horizontal Planers

Several Interesting Examples, together with a Few Applications, of a Class of Machine Tools That Are Not Truly Appreciated

BY W. T. SEARS*

There have appeared from time to time in the AMERICAN MACHINIST cuts and descriptions of doing large or odd jobs that serve to show the ingenuity of man and the flexibility of machine tools.

A head is shown taken from a lathe and turned up or down or end for end; a planer upright is removed or set back or the rail is set up on temporary uprights or bolted to the table and all of these things are done to finish work which could not well be done otherwise in that particular shop. The work was done satisfactorily too, otherwise the article would probably not have appeared in the AMERICAN MACHINIST.

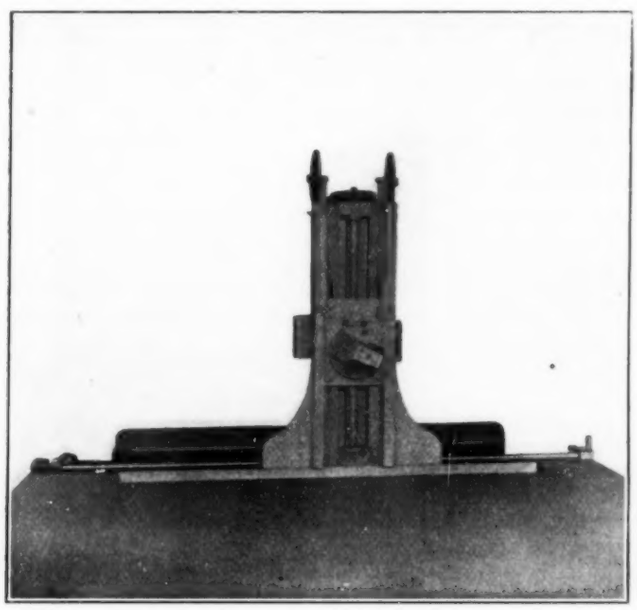


FIG. 1. A SIMPLE MACHINE WHICH PLANES IN BOTH DIRECTIONS

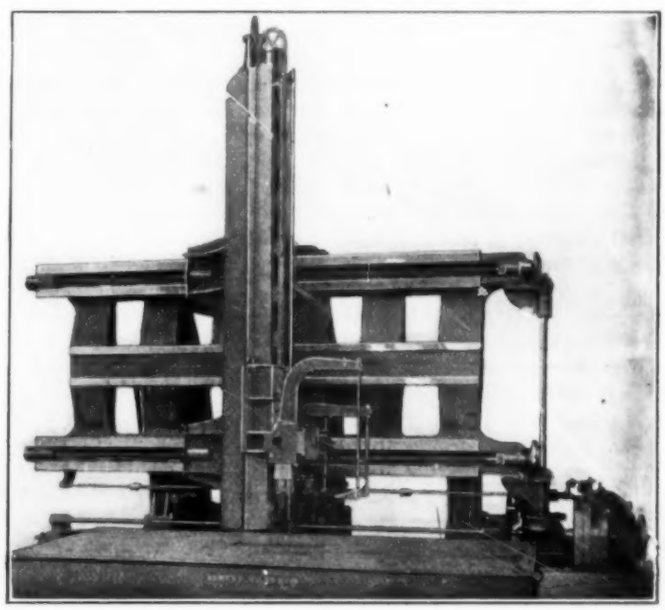


FIG. 2. A PLANER OF THE WALL TYPE

It was partly these articles that suggested the advisability of calling attention to the vertical and horizontal planers built by the Niles-Bement-Pond Company. In addition to that reason there was the added one that these tools have seldom obtained proper recognition as regards their capabilities or been rated at their correct value by users of machine tools and manufacturers at large.

They are not tools which would be classed as manufacturing tools in a shop where a great deal of duplicate work is to be gotten out, nor where all machine operations are moderate in size and fairly simple. Neither are they tools for small jobbing shops, that is, quite small ones, although for a shop of medium size or larger, it would be hard to find a tool which would be better for many unexpected and exceptional jobs, some of which might even have to be refused for lack of just such a tool.

In general, where rather large work is handled now and then, where special unhandy planing work is to be done, where a surface has to be planed in one direction and an adjoining surface at right angles to it, where a surface has to be planed in one direction and cross keyways cut in it, and in fact where a standard planer, shaper or milling machine would oftentimes be expensive or useless, the horizontal and vertical planing machines illustrated in this article will be found most useful and efficient.

Take for instance a large cylinder 6 or 8 feet in diameter by 8 or 10 feet long with bosses or flanges at different points on its surface, which have to be planed or have to be finished by tools sometimes working vertically parallel with the axis of the cylinder and sometimes horizontally at right angles with the axis. For such it would be hard to find a machine even built specially to order which would do this work nearly as well as a vertical and horizontal planer with a base plate fitted up with a revolving work table.

Unfortunately none of the cuts here shown has these circular tables in evidence, but they are simple in construction and most efficient for handling a great deal of work where several surfaces are to be finished in planes at different angles to each other. The time saved in setting is very large and the accuracy obtained with a minimum amount of labor remarkable. The tables are of the same general type as used on the large boring, milling and drilling machines built by the same company.

As a general rule the cost of planing is a small fraction of the cost of the finished product and the actual planing time, that is, the time during which the tool is cutting is a small part of the actual time entered against the cost of the tool as "planing time," for the time of setting will nearly always be a great deal more than the time of planing.

This is one of the reasons that exceedingly high return speeds on any planer are not the great savers of time they appear to be at first glance and it is doubtful if they ever pay where it is necessary to complicate the driving mechanism or seriously strain the driving parts to obtain them. In cases where the ratio of return to cut is very low there can be some saving in time made by increase of return speed but the saving falls off rapidly as the ratio is increased. For these reasons, horizontal and vertical planing machines are seldom provided with a very quick return as the actual saving resulting would be infinitesimal, while the added complication and strain of parts would in most cases be decidedly objectionable.

In most of the designs the tool holder

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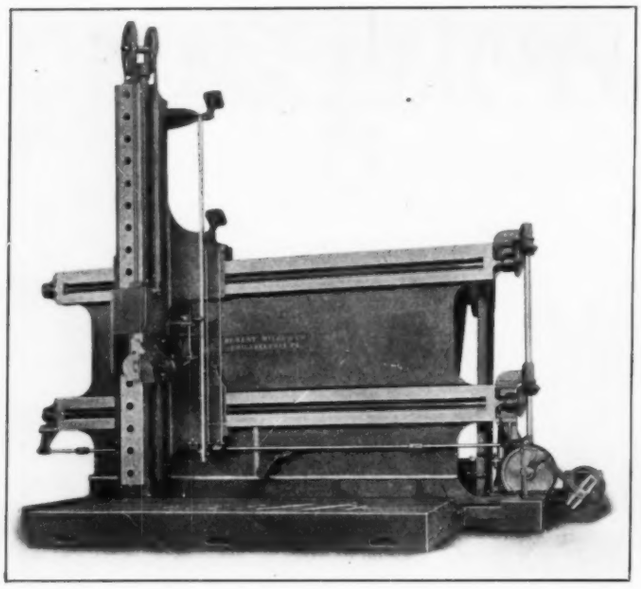


FIG. 3. ANOTHER WALL TYPE PLANER

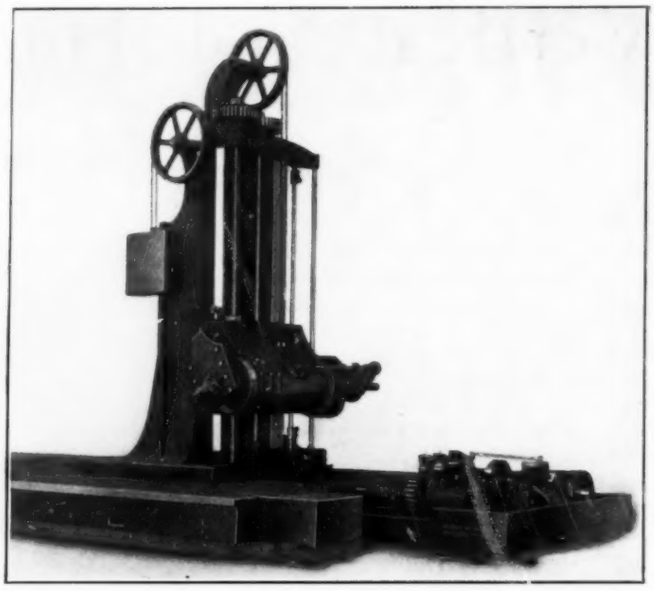


FIG. 4. A LARGE POST PLANER

is arranged to swivel, which makes it possible to plane from right to left or from left to right or vertically up or down.

Referring to illustrations herewith, Fig. 1 is of the simplest type. This machine has a vertical stroke of 8 feet and horizontal stroke of 12 feet, although the horizontal distance can be increased to anything within reason. Fig. 2 shows a somewhat different type considerably larger, of which the following are chief dimensions: vertical stroke 14 feet, longitudinal stroke 16 feet, work table 9½ feet by 19 feet, with a 40 horsepower motor.

Fig. 3 shows another modification with vertical stroke of 9 feet, longitudinal stroke 13 feet, table 6 feet 11 inches by 13 feet, motor 30 horsepower Fig. 4 is still another with vertical stroke of 8 feet and longitudinal stroke of 30 feet, table 4x31 feet, and a 30 horsepower motor.

It will be noticed that the machine shown in Fig. 2 is provided with a quick return and the tool is not arranged to swivel. This was on account of the fact that the machine was for a class of work where it was not considered necessary to arrange for planing in other than one direction vertically and one horizontally. Fig. 5 shows machine illustrated in Fig. 1 working on the end of a large lathe bed. This illustrates very clearly the ease with which it handles work of this sort, and it might be well to mention here that accurate and rapid setting of work is quickly acquired by an operator of average intelligence. The vertical tool marks for finishing the end of the bed and the horizontal marks for the keyway are plainly seen. Fig. 6 shows the same machine finishing up the bottom of a steam-hammer frame.

This machine has just had a new motor drive designed for it. The drive is of the pneumatic clutch type and is so arranged that in whichever direction the planer cuts it can be returned at a somewhat higher speed. It is driven by a motor and the cutting speed is variable from 15 up to 30 feet per minute and return is 20 to 40 feet per minute. This return speed will result in some slight gain in time but, of course, not a great deal. It was, however, obtained without appreciably adding any complication and was adopted for this reason.

It is astonishing the amount of work which will be sent to a machine of this sort after its capabilities have become known in the shop, and it is equally surprising to see how little the machine is appreciated by people who have never studied it in operation or had it strongly brought to their attention.

All these machines were built at the Bement works of the Niles-Bement-Pond Company, Philadelphia, Figs. 5 and 6 being taken in their works.

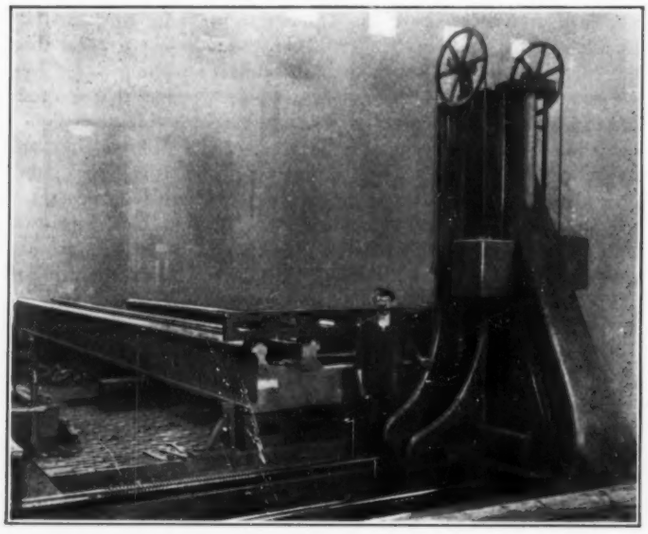


FIG. 5. PLANING END OF LARGE LATHE BED

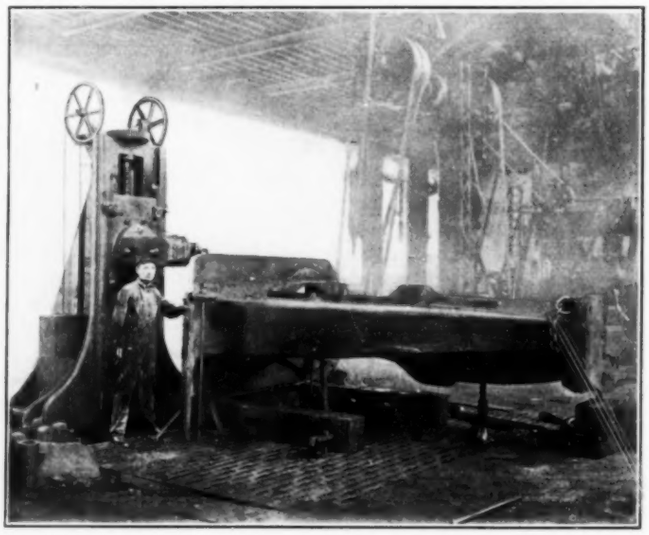


FIG. 6. PLANING STEAM HAMMER BED

Design of a Short-run Plunger Elevator

Complete Details Wherefrom Any Machine-shop Can Design, Build and Install a Plunger Elevator Suited to Its Own Needs

BY C. R. HARRIS

Of the various types of elevators employed in industrial plants the hydraulic plunger machine is probably the best adapted for general manufacturing purposes. Unfortunately the success of this type of elevator in the passenger field, for use in office buildings, has partly eclipsed its usefulness in its original field. As a freight machine it is so simple and its parts are so few, that a shop with small equipment can build and install its own elevators at a low first cost, with practically no annual repairs and with a maintenance expense not to exceed $5 per year.

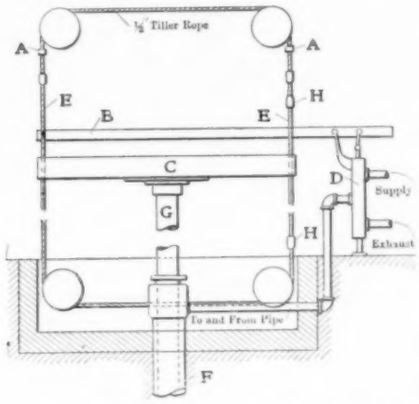


FIG. 1. TYPICAL ELEVATION OF A SHORT-RUN PLUNGER ELEVATOR

I have in mind a group of four elevators, each of about 30-foot run, which are in constant use during working hours and which ran for 25 years with renewals costing less than $50 for all four machines. At the end of this period the plungers had worn about 3/32 inch in diameter, and the management thought best to install new plungers.

Under favorable conditions any industrial establishment with a machine shop could and should build its own plunger elevators where the run does not exceed 35 feet in length. If ledge lies so close to the surface that it would be encountered in setting the plunger cylinder, the proposition would assume greater proportions than most master mechanics could handle without previous experience in this line of work.

How to Determine the Presence of Ledge

The closeness of the ledge to the surface is generally pretty well known; if not known this can be determined as follows: Take a piece of 1½-inch pipe; to one end screw a plugged coupling; drill a ½-inch hole in the plug; to the other end screw an elbow and provide a gate valve. By means of a hose this pipe can be attached to a water supply having not less than 75 pounds gage pressure—100 or 125 pounds pressure is preferable; turn on the water and point the pipe into the ground at the spot chosen to determine the depth of soil above the ledge; the water pressure will wash away the soil and, if the pipe is given a rotary motion with a 24-inch Stilson wrench, it will soon travel down its length if no ledge is encountered. If the ledge is too close to the surface of the ground the installation of this type of elevator had best be left to an elevator company, unless there are firms in the neighborhood who are equipped for oil-well drilling.

FIG. 2. MILL CLEARANCES AND LOCATION OF GUIDE RAILS

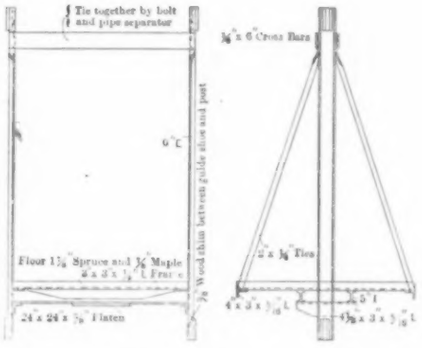

Tie together by bolt and pipe separator
Floor 1⅛" Spruce and ⅜" Maple
24" x 24" x ⅜" Platen
⅜" Wood shim between guide shoe and post
⅜" x 6" Cross Bars
2" x ⅜" Ties

FIG. 3. A SATISFACTORY TYPE OF ELEVATOR CAR

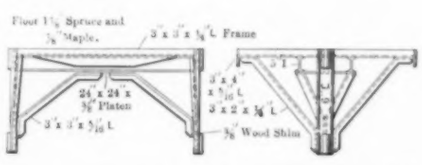


FIG. 4. ANOTHER TYPE OF ELEVATOR CAR FOR LOCATIONS HAVING SCANT HEAD ROOM

Having determined that there is no ledge to be encountered the machine can be detailed and the hole dug for the cylinder. It is the intention of this article to discuss and describe a machine having a run of not over 20 feet. For elevators having a longer run, unless used very seldom, a different type of plunger machine should be used and different methods employed for placing the cylinder in position.

I have assumed that it is desirable to install an elevator without a counterweight and having a run of 20 feet, to carry a load of 3000 pounds at a speed of 60 feet per minute, with a well room of 6 feet 6 inches by 6 feet 2 inches—such a well room would permit the elevator car to be made 6 feet 0 inches by 6 feet 0 inches.

Typical Arrangement

Fig. 1 shows a typical elevation of such an elevator. Here *F* represents the cylinder, *G* the plunger, *C* the car, *D* the controlling valve and *E* the controlling rope. Stops are provided at *A* to prevent the operator from pulling the rope beyond the proper amount to get full valve travel. Travel stops *H* are provided so that by striking on the car at the top and bottom of the run, the elevator will automatically

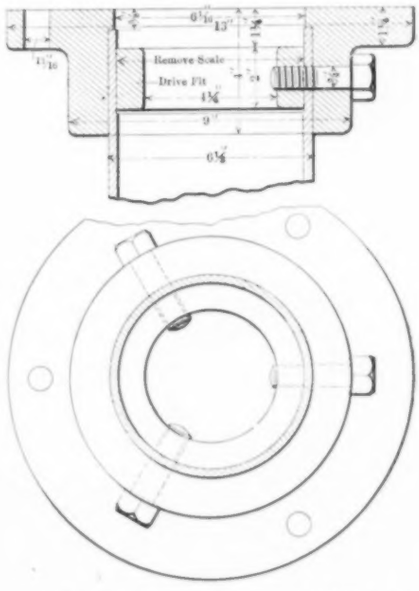


FIG. 5. DETAILS OF PLUNGER TOP FOR A 5½-INCH ELEVATOR PLUNGER

come to rest at the upper and lower landings. Clearances in the well room and location of guide rails are shown by Fig. 2. Maple guide rails are shown, but steel tees could be used if preferred. When wooden rails are installed they should be of maple as this wood is best adapted for the purpose, and will wear about as well as steel.

The Car

There are two types of car which could be used according to conditions. If there was headroom to run the guide rails a car as shown in Fig. 3 could be constructed. No stronger car can be built and the wear on the guide rails is reduced to a minimum. Such a car would weigh about 1000 pounds. Fig. 4 shows a type to be used when the guide rails must not run above the floor of the top landing. This is a good substantial car of lighter weight, but involves some rather difficult bending of angles which would make the cost of the car about equal. This car would weigh about 750 pounds.

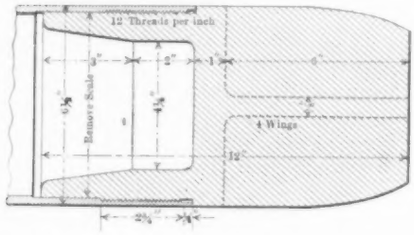


FIG. 6. DETAILS FOR A PLUNGER BOTTOM FOR A 5½-INCH ELEVATOR PLUNGER

The Plunger and Water Pressure

Assuming that the latter type of car is to be used, the size of plunger can be determined. There are two conditions, either one of which might prevail. It is possible that there might be a source of water supply at a given pressure, or that it might be necessary to install a pump for elevator duty. If the latter condition exists a size of plunger can be chosen which involves the least expenditure of money on plunger, cylinder and valve. Under the proposition of pump installation a water pressure of 150 pounds gage would be used as a minimum, and could be carried as high as 300 pounds. A pump installation has the added advantage of using a low pressure for ordinary and average calls, with the possibility of running up the pressure for heavy loads. If the water supply was already available the plunger would have to be made to fit the water pressure.

For an elevator to meet the hypothetical conditions it is desirable to use a plunger 6½ inches in diameter. Such a plunger is made from standard 6-inch steel pipe. The length of plunger will be about 2 feet longer than the run. The water pressure on the bottom of the plunger will have to lift:

	Pounds
Plunger, 22 feet at 14 pounds	308
Plunger top, cast iron	100
Plunger bottom, cast iron	50
Car	750
Friction, stuffing box, guides, ropes	400
Load	3000
Surplus power to give speed	300
Total	4900

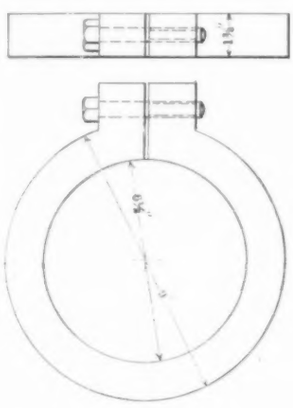


FIG. 9. CLAMP USED TO CORRECT DISTORTING OF PIPE WHEN CUTTING THREADS

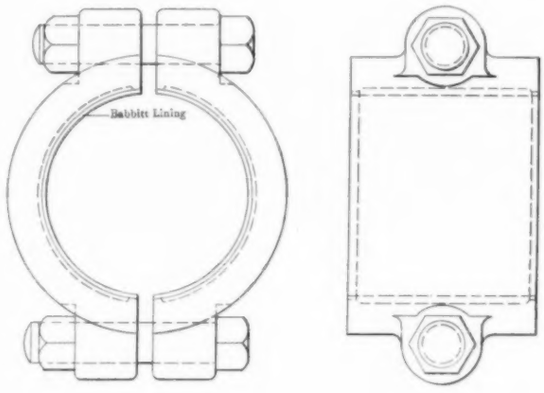


FIG. 10. CLAMP USED TO HOLD PIPE WHEN MAKING UP THE JOINTS

The area of a 6½-inch plunger is 33.183 square inches; 4900 ÷ 33.183 = 148 pounds, or the working water pressure at the cylinder head would be 150 pounds gage per square inch.

When this type of elevator is used but little it is often run from the city water supply with a pressure of only 80 to 100 pounds gage. Under 80 pounds pressure the load conditions would vary somewhat due to larger plunger and increased friction load:

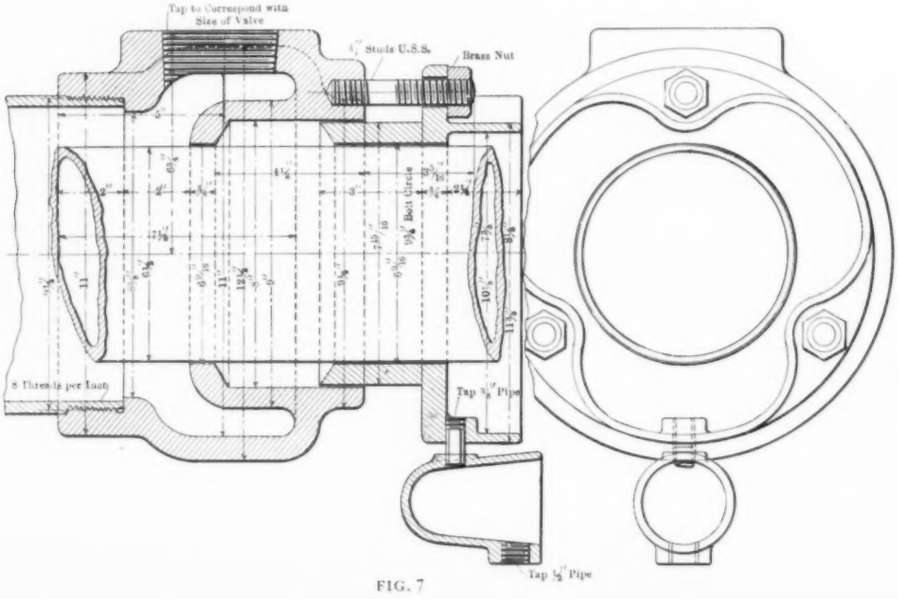


FIG. 7

CYLINDER HEAD AND STUFFING BOX FOR PLUNGER ELEVATOR

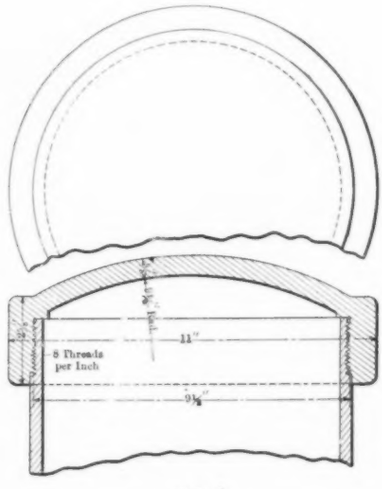


FIG. 8

CYLINDER CAP FOR PLUNGER ELEVATOR

	Pounds.
Plunger, 22 feet at 24 pounds	528
Plunger top, cast iron	300
Plunger bottom, cast iron	200
Car	750
Friction	500
Speed	300
Load	3000
Total	5578

Now, $5578 \div 80 = 70$, or the plunger

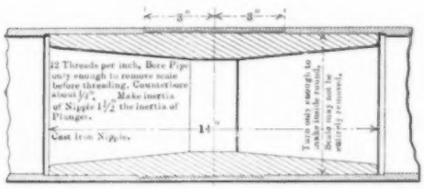


FIG. 11. INTERNAL COUPLING USED TO FASTEN TWO SECTIONS OF PLUNGER TOGETHER

must have an area of 70 square inches. This calls for a 9½-inch diameter plunger. As a 9-inch pipe is often hard to find, it might be necessary to use a 10½-inch plunger.

The details of a plunger top for a 6½-inch plunger are shown by Fig. 5; for plunger bottom by Fig. 6. The wings are provided to relieve the pressure in the cylinder in case the elevator should by accident overrun the top landing.

Cylinder Head, Stuffing Box Cap, etc.

The cylinder head and stuffing box are shown by Fig. 7. In starting the elevator the oil chamber on the stuffing-box gland should be filled with water so as to cover the ⅜-inch pipe opening by about ¼ inch; oil should then be added to fill the chamber. There is a wide difference of opinion as to what constitutes the best packing for this service. Rubber brake tubing when used with the right oil is probably the best packing for freight work.

The cylinder is closed by a cap of the design shown by Fig. 8.

There is a tendency for pipe to spring somewhat out of round after being turned. A clamp as shown by Fig. 9 will be found necessary in cutting threads on the plunger, as this part of the work must be accurately done and the fits made tight. To screw plunger parts together a pair of clamps as shown by Fig. 10 will be indispensable. When a single length of pipe cannot be found of sufficient length for the plunger, the lengths are coupled together by an internal coupling as shown by Fig. 11.

The cylinder is coupled as shown by Fig. 12. After being assembled, and before being erected, both plunger and cylinder should be independently subjected to a

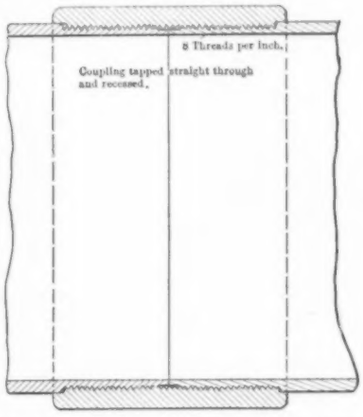


FIG. 12. EXTERNAL COUPLING FOR TWO SECTIONS OF THE CYLINDER

hydrostatic pressure of 400 pounds per square inch.

The Valve Controlling

Fig. 13 shows a section of a lever type, three-way, balanced, controlling valve. If no back pressure existed on the exhaust lines, the body of the valve could be cut off at *A A* and the water taken out of the end of the valve. The valve stem would be cut off at *B B* and one packing saved.

In some installations a lever cannot be used. The lever fulcrum casting is then replaced by a drum head as shown by Fig. 14. The valve-stem link is replaced by a rack with which meshes a pinion; a drum is provided about which the con-

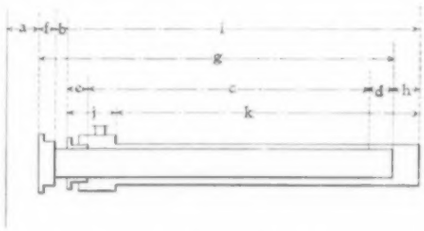


FIG. 21. CHECKING DIAGRAM TO DETERMINE PROPER LENGTH OF PLUNGER AND CYLINDER

trolling rope winds; the drum shaft and the pinion shaft are connected by gears which allow any rope pull and therefore any leverage desired. This construction allows of easy change if the rope pull is not correctly estimated in the beginning.

Fig. 15 shows the "to and from" port drilling. This drilling is blue-printed, pasted onto the outside of the valve lining and drilled. The supply drilling is similar but should not be graduated; the whole port opening should be drilled full of holes.

It will be noted that the female packing washers are provided with shields. In some cases these are not necessary, in other cases they are, but it is almost impossible to predetermine this before the elevator is tried out. They should always be provided and if not necessary, this fact will develop as the elevator is tested out. They should be cut in the

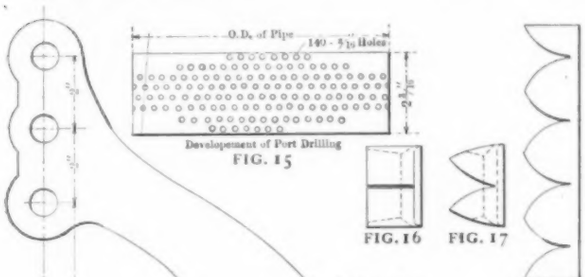


FIG. 15

FIG. 16

FIG. 17

FIG. 18

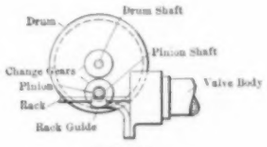


FIG. 14

FIG. 19

FIG. 20

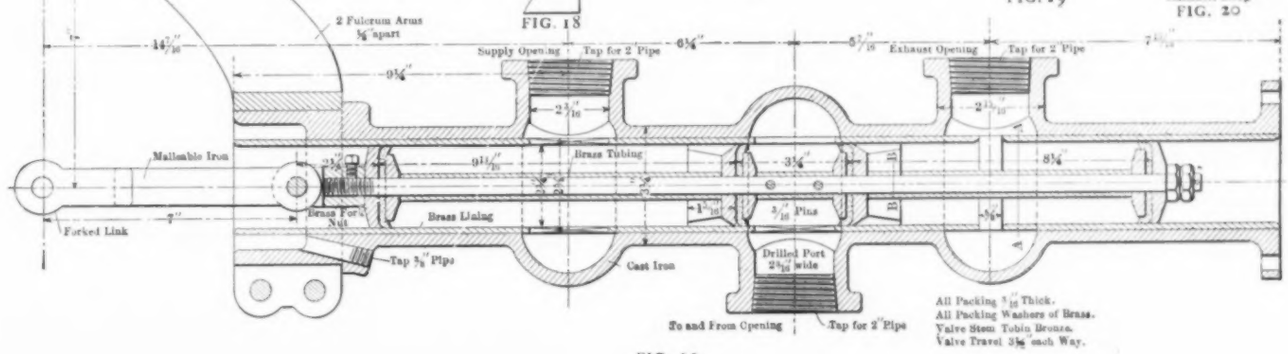


FIG. 13

DETAILS OF VALVE AND ACCESSORIES

shop as shown by Fig. 16; on the job they are gradually opened to the shape shown by Fig. 17, of which Fig. 18 is the development. The cutting is continued until the desired stop and speed is reached.

Fig. 19 shows a maple guide-rail splice.

Fig. 20 shows one-half of the rope stop: the bars should be so located that the rope is forced into a serpentine outline when the two halves are bolted together.

It is customary to limit the speed of the water through the valve at from 10 to 16 feet per second. With a 6½-inch plunger, and an elevator speed of 60 feet per minute, we would have: $A : x = s : S$, in which A is the area of the plunger, x is the area of the supply pipe, s is the speed of the water in feet per second in the supply pipe and S is the speed of the elevator in feet per second. Then

$$x = \frac{33.1}{10} = 3.3,$$

or a 2-inch supply and exhaust piping with corresponding valve should be used.

Fig. 21 shows a diagram for determining proper length of plunger and cylinder to prevent errors.

How to Determine the Size of Pumping Plant

After the solution has been carried this far the determination of the pumping plant is a very easy problem. Suppose the elevator makes a round trip every two minutes; it will require 1.724 gallons per foot of run, or 34.5 gallons per trip, which is equivalent to 17.25 gallons per minute. Allowing 10 per cent. slip in the pump, it would be necessary to have a pump with a discharge of 19 gallons per minute. This result is based upon the installation of a tank to carry the momentary draft when the elevator goes up.

The elevator will go up in ⅓ of a minute and require 34.5 gallons of water in that time. The pump will furnish 6 gallons of water in ⅓ of a minute, which leaves 28 gallons of water to be drawn from the tank. The tank should contain 40 per cent. of air and be of such size that the drop in pressure will not exceed 10 pounds per square inch.

If

p = absolute pressure of the supply,
x = per cent. of air in tanks,
d = required draft on tanks, and
o = absolute pressure after draft,

the

$$p - x = (x + d)\, o$$
$$p - x = x.o + do$$
$$p - x - x.o = d.o.$$

If y = pounds drop in pressure, $y\,x = do$, $x = 434$.

The total tank capacity would be 1090 gallons.

A triplex pump with belt-shifting device is probably the most satisfactory outfit for the average factory.

The economy of operation can be increased by placing the discharge tank upon the roof, or by using a closed discharge tank. The maximum allowable back pressure would be

	Pounds.
Plunger	308
Plunger top and bottom	150
Car	750
Friction	400
Speed	300
Buoyancy of plunger	287
Total	2195

Now,

$$\frac{2195}{33} = 66.5 \text{ pounds.}$$

In order to get this pressure in the average factory it would be necessary to use a closed pressure tank and this would not be advisable for a small number of elevators.

Estimate of the Cost

The cost of an elevator as described should not exceed the following:

Plunger	$ 28 60
Plunger top and bottom	7.50
Cylinder	22.00
Cylinder top and stuffing box	14.00
Cylinder bottom	4.00
Car	50.00
Valve	15.00
Rope	3.60
Sheaves	4.00
Piping	50.00
Tanks	150.00
Guides	1.50
Guide supports	5.00
Erection	150.00
Digging cylinder well	50.00
Miscellaneous	25.00
Total	$580.20

The pump cost should be added to the above, and if pipe for plunger and cylinder has to be spliced add $15.

The above figures are very conservative and would probably be beaten in the most of shops.

Two elevators of the same capacity would require no larger tank but would require a pump of double the capacity.

Some Railroad Shop Tools

By Ethan Viall

In most of the railroad shops that I know anything about, considerable time is spent in machining the outside of metallic packing rings, various tools being employed for this purpose and various methods of holding the rings being used, but a few weeks ago when going through the Illinois Central shops, at Burnside, Ill., I found that G. M. Crownover, the superintendent, had been casting the packing rings to the size and shape wanted, and simply reaming out the hole.

FIG. 1. MACHINE MOLD FOR PACKING RINGS
FIG. 2. SOME OF THE RINGS ON THE GATES

For the casting, a machine containing three or more molds, or a "gang," is used, and the rings are turned out at a surprising rate and with a remarkably smooth finish. Fig. 1 shows the molding machine. As shown, the mold plate is stationary, the movable plate being a plain flat piece of iron. This movable plate is operated by the hand-lever mechanism fastened to

the end of the bench. The hose attachment shown is connected to the air supply and is used to blow out the molds after the castings have been removed.

How It is Used

In using this machine, it is closed, the metal poured and as soon as sufficiently hard, the plate is drawn back and the casting knocked out of the mold, when it falls into the inclined chute and drops into the box at the bottom, the mold is then

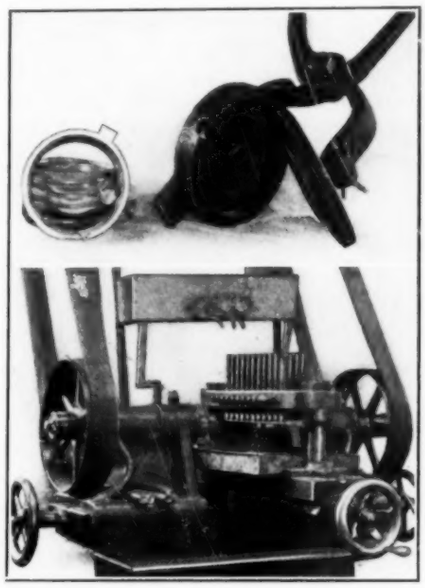


FIG. 3. A HAND MOLD
FIG. 4. SQUARING ENDS OF RODS

blown out, again closed up and the operation repeated.

Fig. 2 shows a bench full of the "gang" castings. These are sawed apart on a band saw and smoothed up on a special grinder. As will be noted on examining these castings, the gates are so placed as to be easily cut off and smoothed up without interfering with the vital fit of the ring.

Fig. 3 shows a pair of hand molds that are used for some of the rings when it is not desired to use the machine.

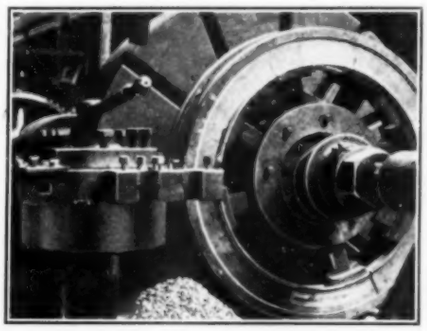


FIG. 6. TURNING PISTON RINGS

Squaring Rod Ends

Fig. 4 shows a milling machine used to square the ends of iron pins. Twenty-four pins are cut on two sides at one setting.

A Bolt Straightener

Another thing that attracted my attention was the trip hammer, shown in Fig. 5. This is an entirely "homemade" affair and is used to straighten bent bolts. These old bolts are sent into the shop by the carload from various points of the system and are straightened under these hammers and recut. The mechanism of this hammer is too simple to need any explanation other than the cut gives.

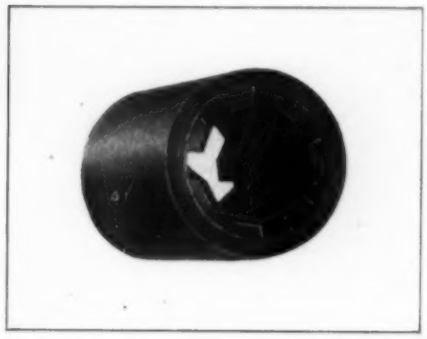
Turning Piston Rings

Fig. 6 is the expanding mandrel used to hold locomotive piston rings while being machined. The mandrel holds two rings, and both are finished at once, the double-turret tools being made especially for this work. The inside of the piston rings are not turned at all, this shop being ahead of most of the other in this respect, though this practice is more common in locomotive, than in automobile or gas-engine shops.

FIG. 5. DROP HAMMERS FOR STRAIGHTENING BOLTS

A Peculiar Broaching Job

An example of the growth of broaching in machine work is shown in the accompanying illustration. This has six spiral grooves with an internal bore of 5/8 inch and is 2 inches long. It was done at one stroke in a special broaching machine of



A PECULIAR BROACHING JOB

the Lapointe Machine Tool Company, Hudson, Mass., so arranged as to revolve the broach at the same time it was pulled through the work.

A successful experiment with a gas-driven ship was recently conducted with an old British gunboat of about 700 tons, which made a trip of about 14 miles demonstrating the applicability of gas propulsion to slow-going ships. The old steam machinery which was of the usual horizontal triple-expansion type with two navy boilers was removed, and replaced by a single-acting gas-producer plant, and five-cylinder engines. The features of the demonstrations were the economy of coal, it being calculated that the consumption of anthracite was equivalent to 0.8 pound per indicated horsepower per hour, while the machinery, weight for weight, was 25 per cent. less than that of the old equipment, and consequently there was a considerable saving in space.

The following examples are given of the effect of adding before fusion a certain proportion of a sample of tantalum containing oxygen to pure metal, according to a British patent specification describing a process by the means of which the hardening of tantalum by oxygen can be carried out without great increase of brittleness: The addition of 1 per cent. of the hardening agent produced a marked increase in hardness, at the same time giving a corresponding increase in brittleness. The addition of 2 per cent. showed some improvement, while with 10 per cent. added the material obtained was so hard that it could not be worked, while the brittleness was very slight.

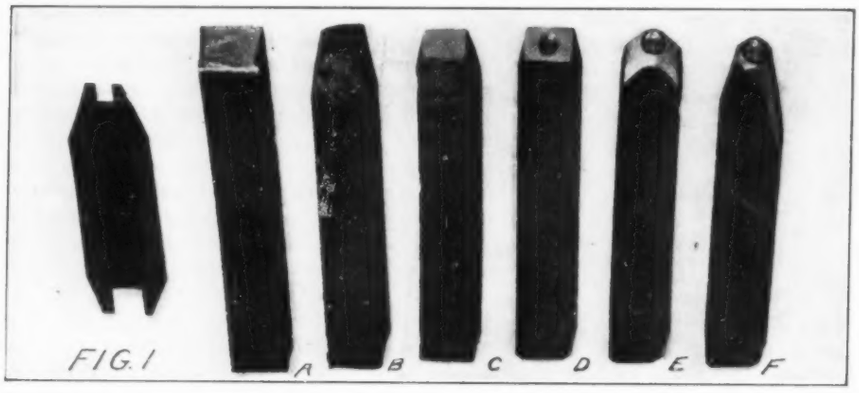
The Making of Steel Stamps for the Machinist

The Tools and Methods Used by the Practical Modern Steel Stamp Maker in Producing Good Work in a Commercial Way

BY P. E. NOYES

The making of steel stamps has long been a mysterious subject to the uninitiated, and to most minds, mechanical as well as otherwise, there arises a vague mixture of hand tools, files, etc., whenever the subject of steel letter-cutting comes up. Perhaps the most common fallacy in regard to making steel stamps is that a steel impression block is used from which the letters and figures are made. While this fact is true of the very cheapest of steel letters which are on the market it finds no place in making stamps that are made to do good work for any length of time.

Perhaps it would be well before going farther to explain the proper uses of an impression block, for there are cases where it is proper to use such a block. An impression block is a piece of good steel in which a set of letters and figures has been struck as deeply as possible, leaving good, clear impressions in the block which is now carefully hardened and tempered. The block is now ready for use, and in making cheap letters and figures it is fitted into the bed of a drop press and the blank stamps struck into it one at a time in the manner that all drop-press work is done. A few years ago a company was formed to make these impression blocks—each containing the letters and figures, and was designed to be used by machinists to make their own stamps (using a hammer instead of a press), but the idea was so impractical that the company was forced to give up business.



FIGS. 1 AND 2. GAGE AND STAMPS IN PROCESS OF MAKING

There is one line of work, however, where the impression block, or matrix, as it is sometimes called, is used to advantage, and that is in making typewriter type. Instead of being struck into the matrix the type blanks are forced into it by a peculiar rocker motion called "kneading." As these type are made of soft steel and case-hardened, the process is very successful, especially as these types are used only on paper.

But to return to our description of stamp-making; the steel used in the best letters and figures is almost always Jessop's make, but some of the American steels are nearly, if not fully as good, and as they do not cost as much, are being used more, especially since the rapid rise in price of the English steels. In selecting the steel care should be used to get bars which are rolled as nearly square as is possible, as it is very hard to do good stamping with letters made on other than perfectly square steel.

Forging the Blanks

The first operation in making a set of figures is to forge the blanks. When a gas forge is accessible it is very convenient to cut the steel all to the length of the stamps, which is about 3 inches, and then to heat the ends and bevel them down on all four sides, leaving the face slightly larger than the figure to be cut upon it. Illustration *B*, in Fig. 2, shows a forged blank. The bevel should run back about ½ inch. When gas is not used for forging it is quite common to forge the ends of the bars as long as can be handled, and then cut them off. In this way there is no danger of losing pieces when "there are too many irons in the fire." After the required number of blanks have been forged they are tied in a bundle with soft-iron wire, or better, they are placed in a cast-iron box and carefully annealed. Too much care cannot be used in annealing, as underheating means hard stock, which cannot be worked easily or quickly, while overheating is fatal to the life of the stamp. The forging process has a twofold object, in that it refines the grain of the steel so that it will stand more use and also shapes the blank, saving a large amount of filing or grinding.

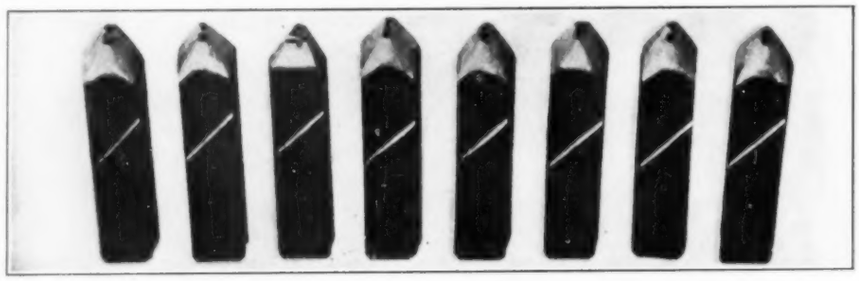


FIG. 3. A SET OF "COUNTERS" OR INSIDE STAMPS

After being annealed the back ends or heads of the blanks are rounded over on the emery wheel, or with a bastard file. This is done so as to facilitate handling the blanks as well as to assist the hammer in striking an even blow when the stamps are in use. Next the blanks are reduced to the same length—the surplus steel being removed from the forged end, as shown in illustration *C*, Fig. 2. If the pieces have been carefully cut off this operation should not take long, and is usually done by placing the blank in the gage shown in Fig. 8, which is held in the vise with the blank while the forging is filed to size. The top plate of this gage (which is shown face down) is hardened and the stop is adjustable so that any required length stamp may be obtained. In the best equipped stamp shops, disk

grinders have replaced hand filing wherever possible, and with its aid better and quicker work may be done. In using the disk grinder for this operation a set of stamps are clamped together and faced off all at once, and at the same time brought to an even length.

The First Step

The blanks are now ready for the letter-cutting proper, and the first step is the process of countering. A counter is a steel punch, which, when driven into the end of a blank, will make an impression exactly the same as the inside of a figure, or as it has been aptly expressed "like a figure turned inside out." Fig. 3 shows a set of counters used for making a set of ¼ inch figures. All counters for regular work are filed with a 60-degree bevel from the face in all directions. A great deal of care is used in making counters, or master-punches as they are sometimes termed, for hundreds of stamps are made from one counter, and thus it will be seen how important it is to have them made right. Counters are hardened and drawn to a purple color, although counters for figures 7 and 0 may be left harder because they are not likely to break, being solid. A set of figures as shown in Fig. 4, consists of nine stamps, the 6 being inverted and used for the 9. To make such a set, eight counters are required, figure 1 being made with the file alone as a glance at the illustration will show.

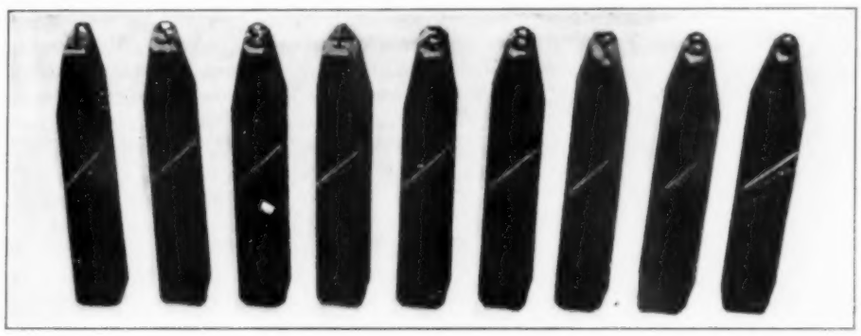


FIG. 4. A SET OF FINISHED STAMPS

In use, the blank stamps are held in the vise face up, and the counter is driven into the face of the stamp to its full depth, care being taken to locate the impression centrally, and also to see that it is driven in perfectly straight. If properly done the impression made will make the inside of the figure complete, and at the same time leave it very nearly the correct size. Illustration *D* in Fig. 2 shows an *O* after being countered and ready to be filed up. In the illustrations the *O* has been used for example for the reason that it is easiest made and shows clearly the point in view. It has been contended by some of the old school steel letter cutters that countering distorts the grain of the steel and detracts from its lasting qualities, but while the theory of this idea may seem plausible, in practice it has been found that countering does not impair the life of the stamp to any noticeable extent.

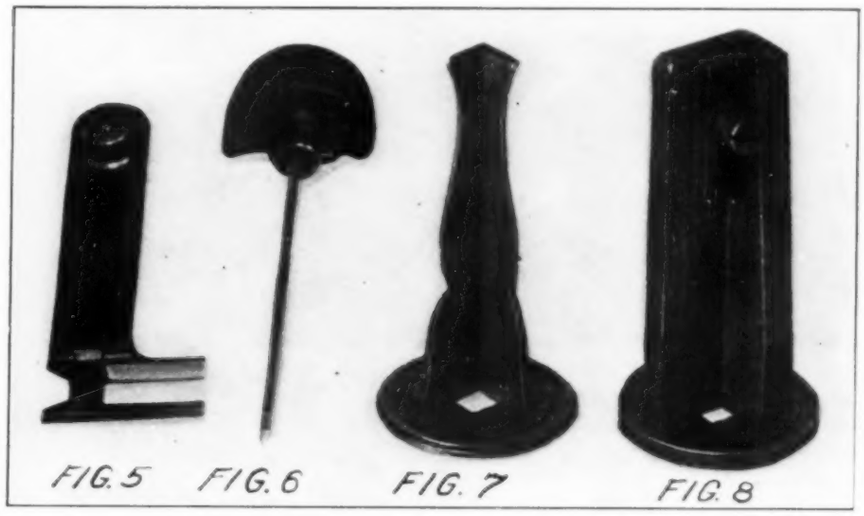
Filing to Shape

But to return to our set of figures which are now in the condition of illustration *O*, Fig. 2, and ready to be filed to shape. First, the surplus steel around the countered figure is roughly removed with a coarse file, always maintaining a 60-degree bevel all around the figure. For the finish filing a strip of wood about 6 inches long and 1 inch square with a V cut in one end can be used to good advantage by holding it in the vise, on a line with and parallel to the jaws, the V-end projecting 3 or 4 inches to the right-hand side of the vise. Against this stick the stamps are held with the left hand while filing the stamps to shape.

A "facer" as shown in Fig. 7 is used to insure the face of the figure being square with the sides of the stamp, and to remove any roughness caused by countering. The stamp is held in the facer with the hand and lightly faced off with a fine file, using the stick in the vise to steady the faces and stamp while filing. A barrette or safety-back file will be found very useful in finish-filing, as with it there is no danger of doing damage with the back of the file. For bringing the figures to exactly the same size face some use a caliper square with the jaws beveled to an edge like that shown in Fig. 5, though a thin, solid gage as shown in Fig. 1 is more common. The back end of the jaws is filed to an angle of 60 degrees, and is useful in keeping the bevels of the stamps uniform. In filing the figure 1, it is first brought to size with the caliper square, and then the sides filed into shape.

In finish-filing a much better stamp is obtained if a very light face is left around the countering instead of filing exactly up to a sharp edge. If stamps are to be used on wood or leather they should be filed to a much sharper angle than 60 degrees, as not nearly as much strength is required and a better impression results, cutting rather than breaking the fiber of the wood.

The combination of filing and countering should theoretically produce a finished stamp, but almost always it is necessary to "touch up" the stamps afterward with a graver like that shown in Fig. 6, although the less work of this kind the better. Some steel letter cutters prefer to use a square graver instead of the style shown, but this is a matter of habit, and good work can be done with either. In "trimming up," as this process is called, care must be used to cut down to the bottom of the countering so as to have the bevels even.



SOME OF THE TOOLS AND GAGES USED

Finishing the Stamps

The letter-cutting proper is now completed, and it remains to do the finishing work on the stamps, which now appear as in illustration *E*, Fig. 2, and to harden them. The first step after the letter cutting is to cut the steel away from the letter for a distance of about one-half inch from the face, as shown in illustration *F* Fig. 2 This is usually done by holding the stamp near the face, in the left-hand corner of the vise, and using a 12-inch coarse

file to do the work, filing the steel away on a bevel to within a thirty-second of the face of the figure. After the steel has been beveled away from the four sides the corners are also slightly filed away. Not only does this filing improve the appearance of the stamp, but what is more important it makes it easier for those using the stamps to stamp evenly, especially when a number of figures are to be stamped in a line. In doing this beveling the disk grinder is an important factor when quantities of stamps are made.

The stamps are now laid on the bench in a row with the bottoms of the figures uppermost, and one after another is held in the vise while the slant-line denoting the bottom of the figure is filed about midway of the length of the stamp as shown in illustration *F*, Fig. 2. While not absolutely necessary, this line is convenient in that it enables the person stamping to get his figures right side up when using without always examining the face. A line at right angles to the stamp is sometimes used instead of the slant line, but is not as practical, for often in straightening a stamp which has become bent through hard usage it will break at the cross-line when so marked.

Now comes the final operation—that of hardening. For this process a small open gas forge is very handy, as the work is always in sight when heating. On the other hand, the advantages of the charcoal fire are too well known to be here enumerated. In the gas furnace the heat is always under control, and is very even. The stamps should be heated to a bright cherry red from the face a distance of about 1 inch and plunged straight down into a tank or pail of cold brine and left there until cold. The part hardened should include the beveled part—more is unnecessary, and the back end is left soft. After the stamps have been tested for hardness with an old file the beveled faces are polished on the side of a fine emery wheel, or better still, on the disk grinder until all file marks are removed.

Tempering

The temper must now be drawn and by far the best way is to draw the stamps in oil heated to 440 degrees Fahrenheit. This method, however, is not practical when only a few stamps are made at a time, and in such cases it is quicker to draw them over a gas flame or on a hot plate and cooled when a light straw color appears. An excellent heat for drawing stamps and other small articles is obtained by using an inverted electric flatiron.

For illustrative purposes one-quarter-inch figures and counters for same have been shown, as the smaller sizes would not show as clearly. One-quarter-inch figures require steel 7/16 inch square unless for heavy work, when ½ inch square is better. For one-eighth figures, 5/16-inch square steel is used, and for one-sixteenth- and three thirty-second-inch figures, ¼-inch steel is used.

Counters are made of the same size steel as the figures they are to make, except that they are left only 2 inches long, to make them as solid as possible. For the same reason no long bevels are filed on the sides of the counters.

The letters of the alphabet are made in the same way as the figures, but are not shown for lack of space. The making of steel stamps containing two or more letters like name stamps, etc., requires more careful work and experience in handling small chisels and files, but the method in general is the same as has been described.

Some Antique Machine Tools No. 4

By E. A. Dixie

Fig. 14 shows one of the oldest tools in the shop. It was built for drilling loom rails so that they would be interchangeable. Some of these rails are shown in the foreground to the left.

The holes are drilled where the bosses are in the castings. Formerly the machine was equipped to drill two horizontal holes and one vertically, the latter being tapped in a subsequent operation for a set screw. The rails are clamped to the vertical face in which the holes show in the half-tone. The upper face of the carriage is provided with clamps, so that various standard spacing bars can be secured to it. Above this is shown the indexing mechanism, which is merely a plug which engages with the various holes in the spacing bars. The machine is about 20 feet long and is still used for drilling rails, but now only one hole is drilled at a time. Fig. 14 shows a bolt cutter of uncertain age, but at least 60 years old.

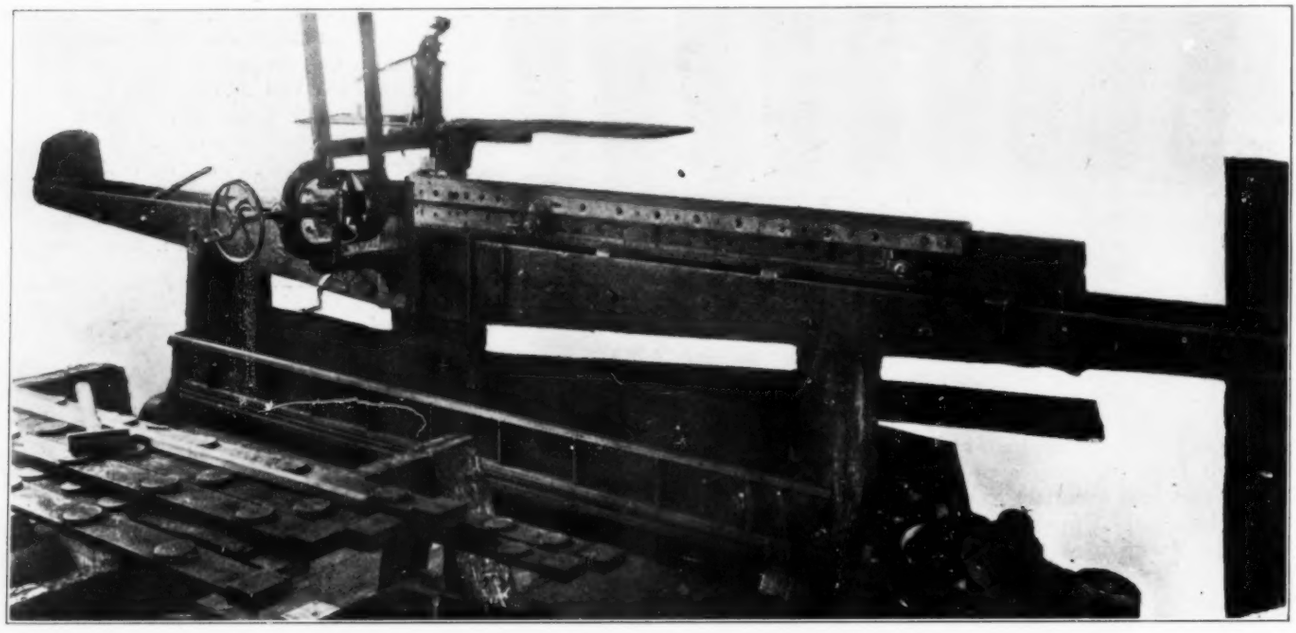


FIG. 14. THE LOOM RAIL DRILLER

The die head is mounted on trunnions on the carriage. The chasers are opened and closed by means of a scroll, the same as in many modern machines. The handle above the die head is mounted on a spindle, the other end of which is provided with a bevel pinion which engages a bevel wheel connected with the spiral.

The disk below the handle is graduated and an adjustable stop is provided, as shown, against which the handle abuts when the dies are set to correct depth of cut. The carriage is moved by rack and pinion. Under the die there is a well for chips and oil and a hand pump at the back

of the die floods the die with oil. The head and bed are cast in one piece.

Figs. 16, 17 and 18 show a very interesting boring lathe. This lathe was designed by Mr. Silver and built about 60 years ago. It swings 40 inches and carries a 4-jaw scroll chuck 35 inches diameter. This scroll chuck I am told was one of the first if not the first made in the United States. The straight, flat bar reaching from the periphery of the chuck to the shears in front has a pin on the end of it which engages with the chuck and holds it stationary while the large spanner wrench at the top is being used to open or close the chuck.

The spindle of the tailstock is round but is secured to a rectangular rack beneath it. The tail spindle is advanced either by hand or power, the power mechanism by means of a worm and worm wheel being shown in Fig. 17, which shows the rear of the tailstock. The worm wheel is free on the shaft carrying the pinion which engages with the rack on the tail spindle, but the small double-ball lever shown in the center of the large ball crank in Fig. 16 controls it and throws it either into or out of engagement with the pinion shaft.

The tailstock can be set over for boring large holes or it can be set at an angle to bore tapers. The tailstock is moved along the bed by pinion engaging with a series of pins driven in the back of the bed. This is clearly shown in Fig. 17. The carriage which carries the flat-drill guide is moved in the same way. Means are provided for clamping both the carriage and the tailstock to the bed.

The back gears and those on the spindle are helical, cut right and left so as to avoid end thrust.

The massiveness of the bed is, I think, worthy of notice. The tool throughout is very heavy for the time when it was built.

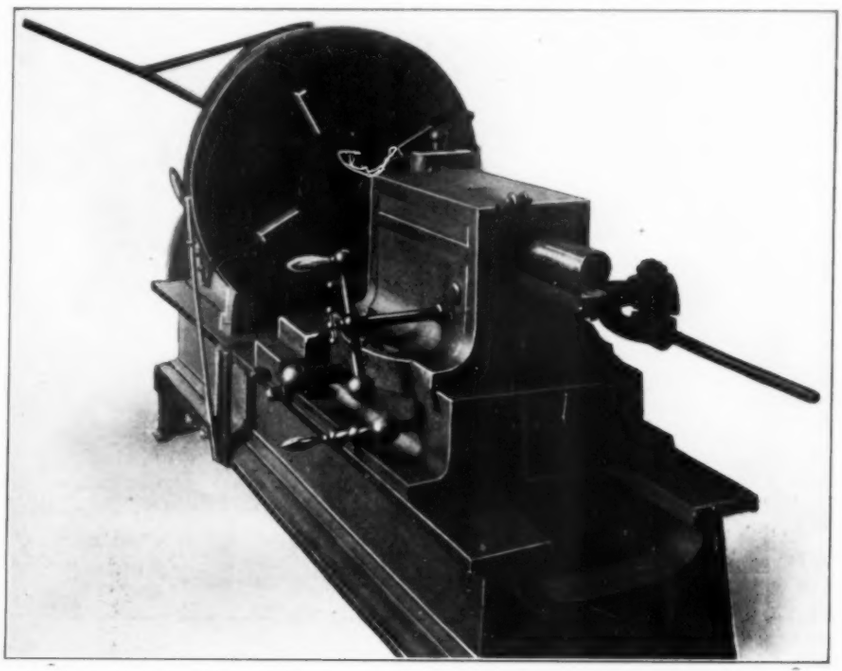


FIG. 16. FRONT OF CHUCKING LATHE FROM TAILSTOCK END

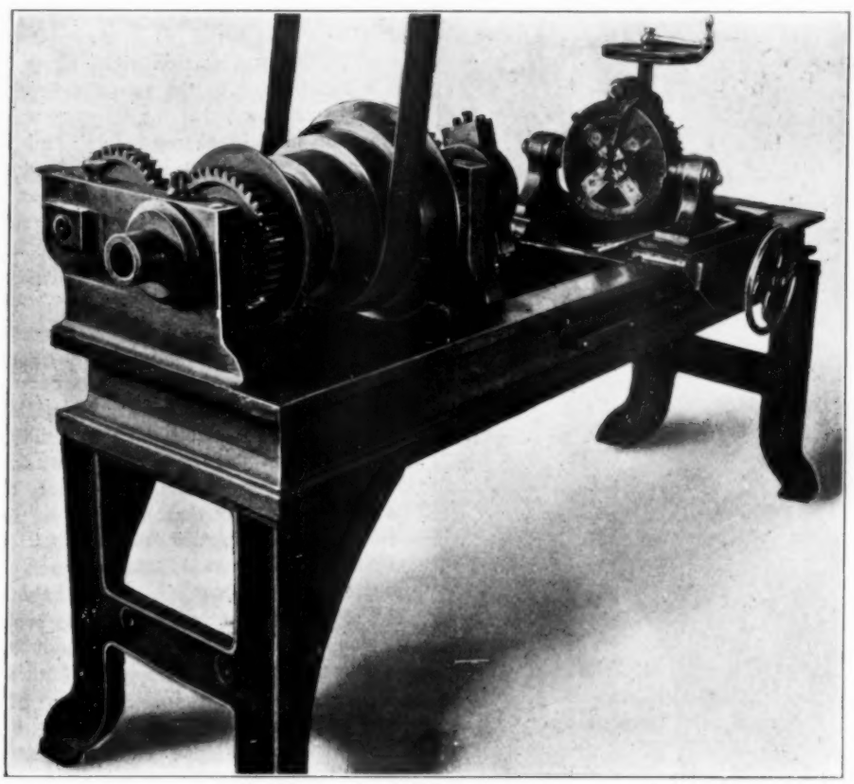


FIG. 15. THE BOLT THREADER

Memory—Natural and Mechanical

By Entropy

The greatest task which shop organization has is to overcome lapses of memory, which are due to intention, inattention, and sheer inability to remember. The installation of a shop system would be a matter of almost unalloyed pleasure, if the human machine could be depended on to run with even the regularity of a dollar watch. Between the three lapses there is little choice, although our sympathies may be with the man who cannot remember.

The man who will not, usually because he believes himself just as good as anybody and wishes to show it by omitting to obey, can usually be brought to terms by the ultimatum of doing as he is told or leaving; especially if the proper psychological moment is taken, which is usually just a day or two before pay-day, when he is feeling the need of a regular envelop. A man of this stamp is usually poor, for his assertions of independence have frequently left him stranded.

The kind who are inattentive can be handled by very much the means that are used by the railroads to compel the attention of brakemen to an approaching bridge. A slap in the face is a rather rude reminder, but it is better than losing one's head. Drastic measures cannot be followed where the only suffering caused by inattention is a delay or inconvenience to someone else. The failure to fill out properly a time card, or forwarding tag,

may upset the order in which work is done and may mean a financial loss, though indirectly.

In designing automatic machinery it is often necessary to make the beginning of one operation dependent on the completion of the previous one. Taking a cue from this shows us that we should make the correct filling out of time card, or ticket, an essential to getting the next job, or to getting pay. If the shop wishes to keep things right up to the mark, it will be a foreman's duty to see that each man is provided with the material and knows well beforehand what he is to do on the next job, which practically cuts out the opportunity to use the first method.

A Mechanical Aid to Memory

The second scheme I saw worked up rather cleverly this summer. The shop used a recorder which printed the time of day on a workman's card. These cards were kept in a rack beside the machine. When the man came in in the morning he was supposed to take out of his place in the rack, the front card, if there were more than one. This card had been filled out by the foreman by writing in the name of the job to be done, the number of parts to be made and the shop order number. The workman stamped his time on entering on the card and also glanced at the next card in the rack, which was his time card for the next job. In this way he knew at once what he was to go to next. If he did not go to the recorder and stamp his time in he would not be able to collect his pay without a satisfactory explanation. The cards showed him, as well as the timekeeper, what his actual time of ringing in was, so there was the least possible chance for dispute.

When he was through work on this particular job he took his time ticket back to the machine, rang "out" on it, took the next card and rang "in" on it immediately and went right to work. If he thought

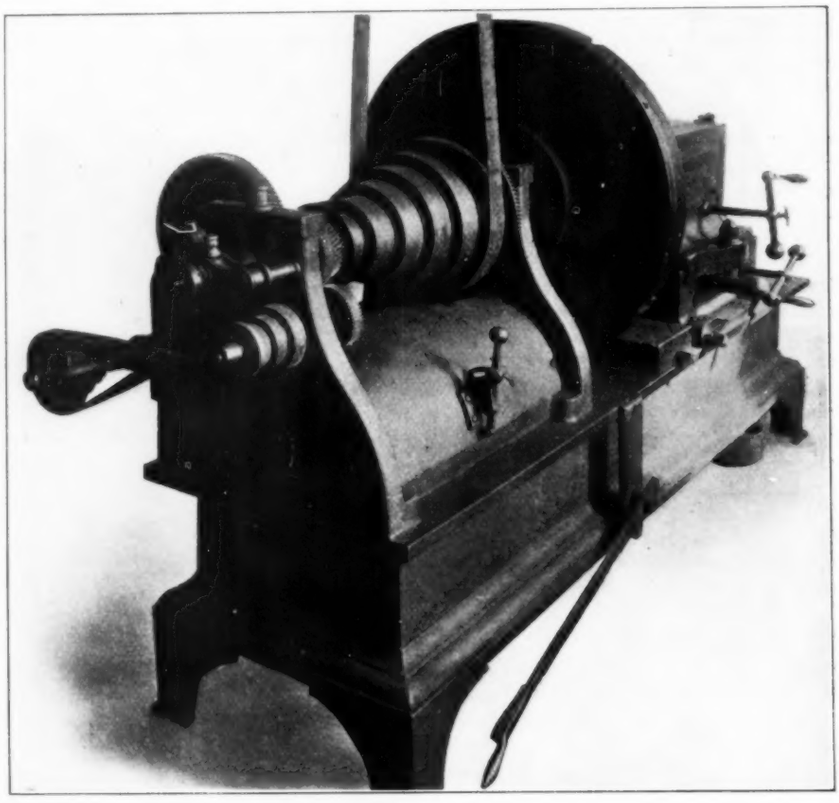


FIG. 18. FRONT OF CHUCKING LATHE FROM HEADSTOCK END

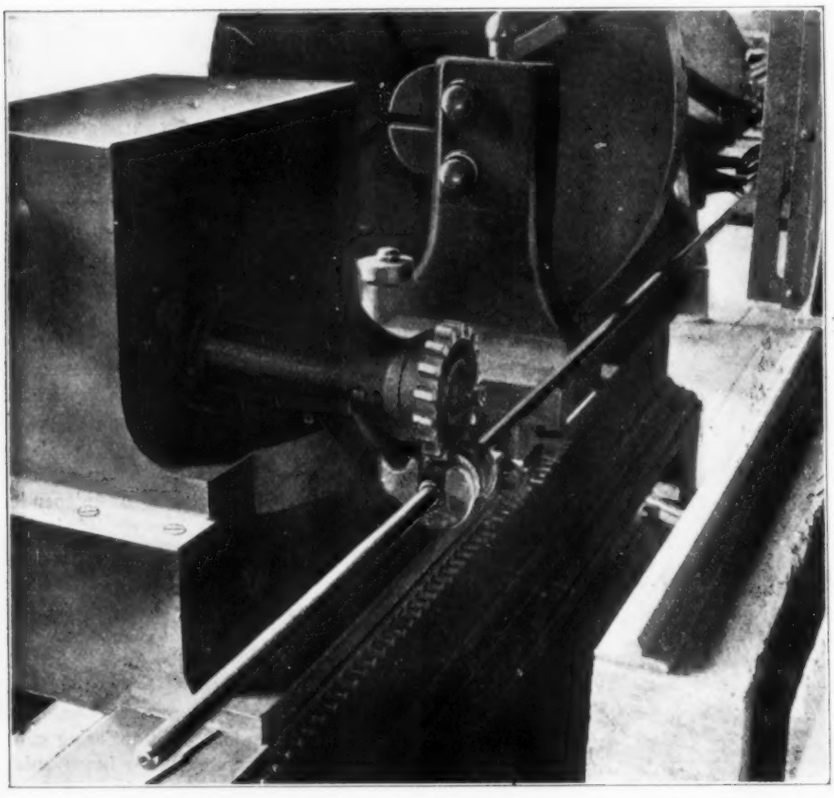


FIG. 17. REAR OF CHUCKING LATHE FROM TAILSTOCK END

that he remembered what the next job was to be, and started right along on it without going to the recorder he took two chances: one that the foreman would see that he had changed jobs, and the other that the foreman had changed his mind and also the ticket; for it was, of course, possible for the foreman to take a ticket out of one pocket and drop it in another at any time as he saw that one man or another was nearing the completion of a job.

If a man had his job done and rang in on that ticket and out on another, the foreman could come along any time later with the first job and the ticket that he did it on, and have him do more work on it or make changes with the certainty that all the work that that man did on that job would be recorded on that ticket and that the office would get all the cost charged up to that job. Also the office could see that the man's time was broken which might account for the high cost, either on account of stopping and starting work more than once, or on account of its having to be done over. A man may have several cards at once, each representing jobs that he has been pulled off from to do rush jobs.

The workmen had no writing to do;

the foreman had almost none. If each man was kept on one machine all the time it was easy to classify the cards by the workman's number. If the men had the run of the shop and carried a job clear through by themselves it would result in having all the different kinds of work on the job mixed up together. If the lathe work or the milling-machine work was wanted separately, all that had to be done was to make a separate card for every part of the job. It seemed to be regarded as fair by the workmen, and certainly it was an easy thing for the office to follow up.

The Man Who Cannot Remember

To get back to my original thought! We have left to consider the man who simply cannot remember; not the man who forgets to mail his wife's letters, but the man who cannot remember that he's to make a driving fit in one place and a running fit in the other, and reverses them. This kind of a chap is a public nuisance; but his wife and children deserve a chance to live if he does not, so we ought to conquer him if possible. In the first place all these nostrums for strengthening the memory are useless. There is one splendid place to train the memory for certain work and that is just where it is to be used. The extent to which a man may unconsciously develop his memory along certain lines is little short of marvelous.

Mrs. Entropy says that my memory is of the worst, but 10 or 15 years ago I numbered some 2000 to 3000 patterns, and ordered castings from those patterns for several years. Before I had been at it a year I did not have to look at the lists to make out an order, or to locate any pattern. I carried all those patterns in my head by their abstract numbers. Now this was not a "feat" of memory at all for here was another man whose education was hardly perceptible, who had the handling of three times as many patterns, none of which were numbered except possibly with a letter or symbol which indicated to what size or style machine they belonged. This man had that lot of patterns at his finger's tips and without a moment's hesitation he would pick out what was wanted. This was not memory in our ordinary use of the term; it was habit.

To form the habit of remembering only one very simple thing need be understood; that is, that the time to make an impression on the mind that will be lasting is when you first know that it should be remembered, not afterward when one is searching for a shred of a memory only to realize that he has forgotten something. The habit of making a memorandum is fatal if the memorandum is constantly being looked up, valuable if it is easily consulted, since in order to write a note it is necessary to think of the subject intently if only for a few minutes. The human brain is much like a phonograph record in that what is once engraved there is likely to remain, at least as a trace, for a long time. If the record is once there it may be recalled at some future time, though if it is a mere scratch it may require some shock or violent reminder to recall it.

On the other hand, the deep, intentional record is most easily recalled. Artificial aids to making a deep impression, such as tying knots in watch chains help only as they keep one's mind on the thing to be remembered, but do no good in themselves, as many a man knows who has fumbled at his chain all day at the shop trying to think why he put the knot there.

Machining Hollow Gas-engine Piston Pins

By N. E. Hildreth

In a previous article was set forth the comparative merits of the fixed and oscillating types of gas-engine-piston pins in which it was stated that the machining of the pins presented some difficulties only learned and overcome by experience. While these difficulties are not complex, nor was it an expensive process to subdue them, yet the time and thought which might be spent upon them would form no inconsiderable item, and it is believed that space devoted to describing them could be profitably employed.

The work, which is represented by Fig. 1, is a piece of mild-steel tubing one and one-half inches in diameter and three-sixteenths of an inch thick. It was 0.25 carbon, case hardened, and ground to a diameter of 1.48 inches. Stock lengths are about 16 feet and are cut up in an ordinary screw machine with wire feed, the inside corner at each end being slightly beveled for admission of the centering cones on the mandrel, which is shown assembled in Fig. 2, and in detail in Figs. 3, 4 and 5. The difficulty experienced in the manufacture of these pins lay in getting a round job.

This difficulty was occasioned by the improper means used for holding and driving the pins in the grinder, which was done on an arbor having a solid cone at one end and a movable cone at the other. On this the pin was secured by means of a nut in a similar but not the same manner as shown in Fig. 1. This method was a failure because in case-hardening, which was done by the conventional bone process, the pieces distorted, and when the cones of the arbor were forced into the pin sufficiently tight to hold it securely in grinding, the distortion of the hardening process was overcome in whole or part with the result that when released after grinding this distortion returned, resulting in an untrue job.

To overcome this the arbor shown in the illustrations was devised. With this arbor the pins are held and driven by their ends, the cones serving to center them only, with the result that there is no distortion and the work can be done by a medium grade of labor. Much of the success of this method is due to the care with which the arbor is made and hence the proper dimensions are given, in the illustrations, to those parts requiring especial care in fitting. The arbor, cones, and sleeves should be made of tool steel hardened and ground, and the springs which force the cones to place should be of steel of about No. 12 wire, five coils per inch, and the ends turned at right angles to the sides.

The first pins made were hardened without removing the scale but it was found that the scale prevented uniform hardening and many of the pins would be either all or partially soft and it was found necessary to remove the scale by turning in a lathe before hardening. The depth of hardening used was one-thirty-second of an inch and about eight-thousandths of an inch was allowed for grinding.

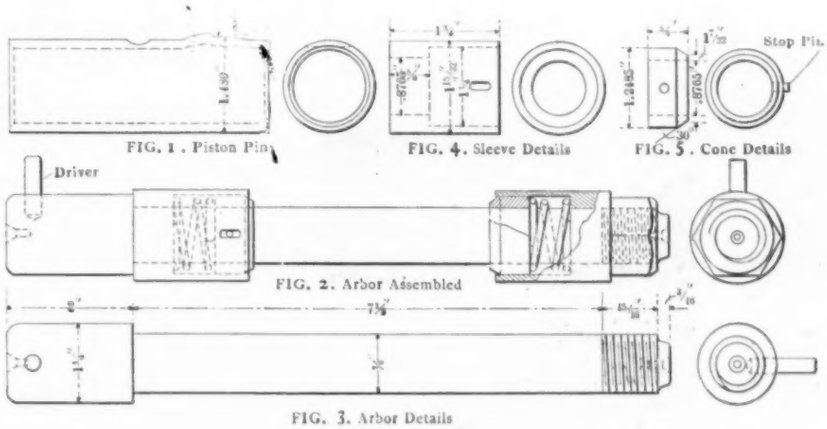


FIG. 1. Piston Pin. FIG. 4. Sleeve Details FIG. 5. Cone Details

FIG. 2. Arbor Assembled

FIG. 3. Arbor Details

MANDREL USED IN MACHINING HOLLOW GAS ENGINE PISTON RINGS

New Method of Making Steel Castings

Castings Made of Any Kind of Steel, from Very Soft to High Speed. Walls and Ribs Cast 1-8 Inch Thick. No Blow Holes or Pits

BY E. F. LAKE

Among the many advances which have been made in metallurgy in general, and in the making of castings in particular, probably none has been received with more satisfaction by the designers and manufacturers than the steel castings made by Flexilis Works, Ltd., of Tempelhof and Berlin, Germany. The exclusive rights to manufacture and sell these castings in the North American continent has been secured by Henry Hess, of Philadelphia, who is well known in connection with the Hess-Bright ball bearings. The metal for the castings is melted in crucibles so that an ingredient, which is being kept a secret, can be added to the steel. This ingredient acts as a medicine on the metal and purifies it, as well as making it flow easily. The secret, however, of making this high grade of castings does not all rest with this ingredient, as the metal must be poured at the correct temperature and the molds be properly made.

Castings can also be made by this process with metal that is melted in an open-hearth furnace, but at present the foundry is only making the very best grade of steel casting and is, therefore, confining itself principally to the crucible castings.

Kinds of Steel Used and Intricate Shapes Cast

These "Flexilis Special Crucible Steel" castings are made of any composition of metal that is called for and Fig. 1 shows a group of castings of various styles that have been cast from many different kinds of steel. Ordinary steel with any carbon content desirable, from the highest to the lowest, is cast by this method, as well as special alloy steels, such as nickel, chrome, nickel-chrome, vanadium, etc. The high-speed and self-hardening steels are also cast into any desired shape.

The castings do not have to be annealed, as with the ordinary steel castings, and consequently deliveries can be made as soon as the foundry can make the molds and clean the castings. This feature of itself is a great improvement over the old method; but when one considers that all kinds of steels can be cast, and these in any kind of complicated shapes, with all kinds of complicated cores; it places steel castings on an equality with malleable iron, cast iron and many of the non-ferrous metals and opens up a much larger field for the usefulness of steel.

The metal can also be cast in a much thinner section than heretofore. In some cases the metal is cast as thin as ⅛ of an inch, while 3/16 inch of metal is quite common and metal ¼ of an inch is cast over large areas and around intricate cores. Ribs ¼ of an inch thick have been cast to metal that was 2 inches thick without any signs of cracks or checks and that with very small fillets where the two were joined together.

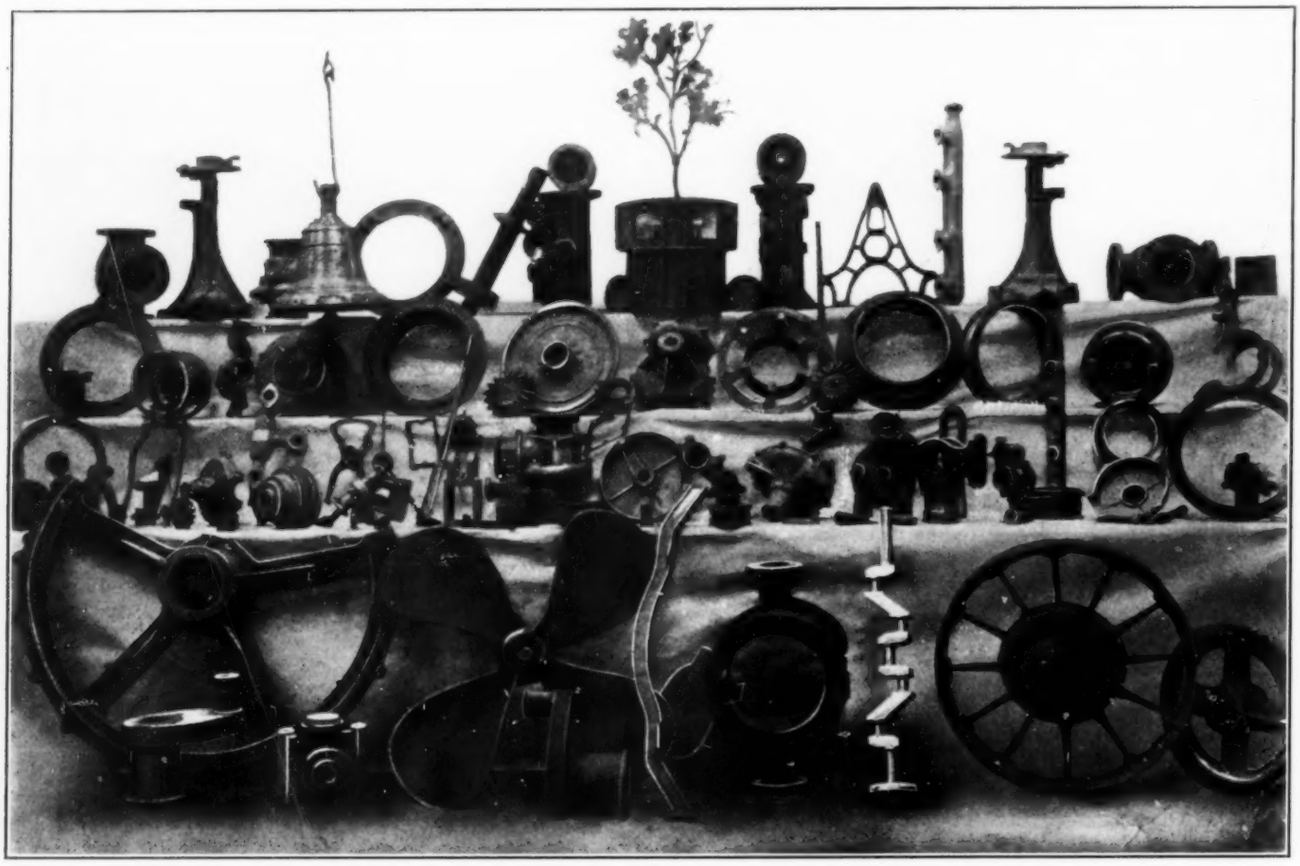


FIG. 1. GROUP OF CASTINGS MADE FROM HIGH AND LOW CARBON, SPECIAL ALLOY AND HIGH-SPEED STEELS

Castings for German Government

Casting *A*, Fig. 2, is a good sample of these castings. It is a valve body that is made in quantities for the Germany navy,

and it resists a pressure of 100 atmospheres per square inch. The thickness of metal around the body and water jacket is but ¼ inch and the flanges are ⅝ inch thick. The freedom with which this steel flows in the mold is shown by the fact that the thickness of metal around both walls of the water jacket is but ¼ inch, as well as around the body of the casting, while the body is 7¾ inches in diameter and 16 inches long. The principal dimensions of the valve are shown in the line cut Fig. 3. This casting has no blow holes or flaws and the loss from bad castings is only 2 per cent.

Another feature that shows the quality of these castings is the spider that is cast in the center of the valve. The three arms that support the boss in the center are but ¼x1⅛ inches and only ¼-inch fillets are used where these arms join the body of the valve. With this construction, moreover, there are no signs of cracks in any of the corners.

Casting *B*, Fig. 2, is a square-pipe connection that has a thickness of metal of ¼ inch; casting *C* is a car stopper for a railroad track that is used by the German Government. The irregular flange in the front is but ⅛ inch thick; and castings

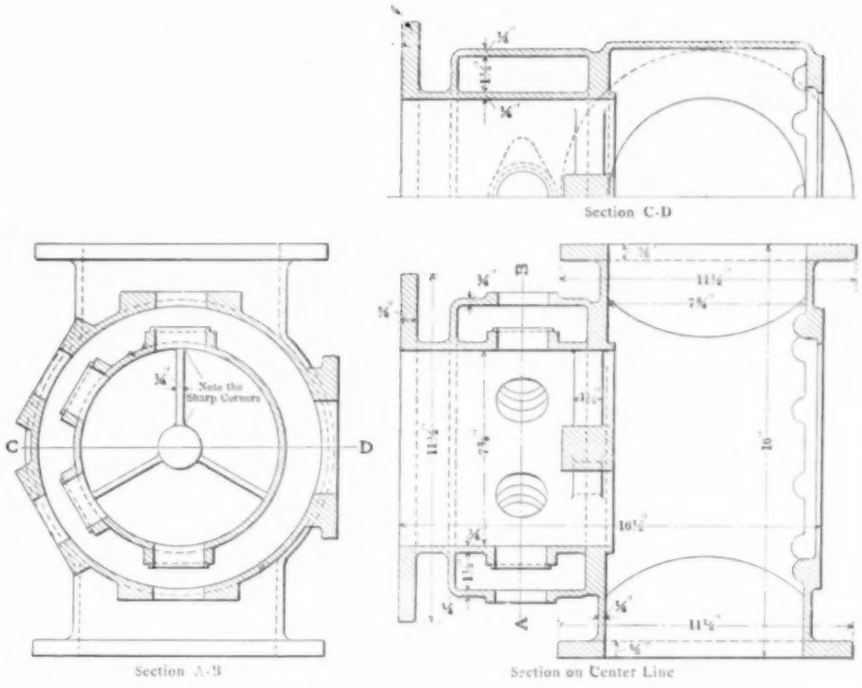


FIG. 3. SECTIONAL VIEWS OF VALVE CAST FOR THE GERMAN NAVY

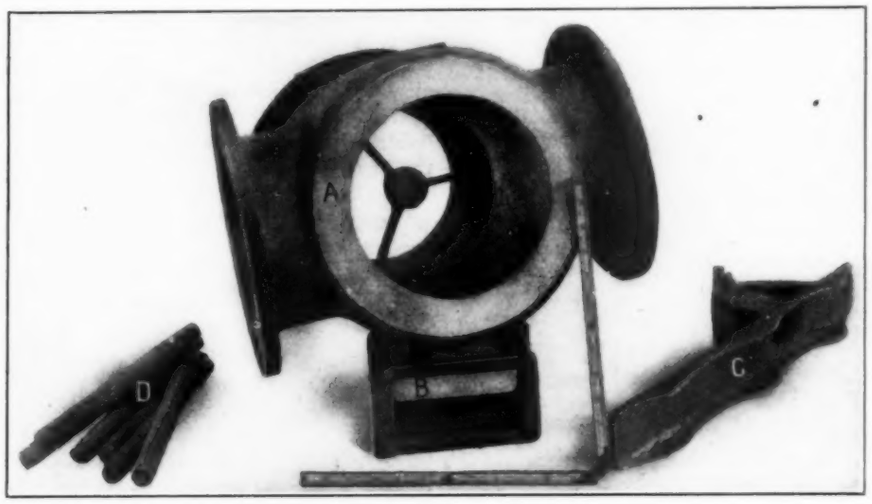


FIG. 2. CASTINGS OF VALVE, PIPE CONNECTION, CAR STOPPER AND RODS FOR WIRE

D are bars that are to be drawn into wire.

Five tests that were made of the metal in these castings gave an ultimate strength of from 48,700 to 53,000, with an elastic limit of from 25,950 to 26,550 pounds per square inch, an elongation of from 26 to 27½ per cent., and a reduction in area of from 41 to 41.7 per cent.

Standard Brands of Castings

While any specifications, that are possible in rolled or forged stock, can be cast by this process, the foundry has three standard brands which are being cast every day. These are named weldable, medium hard and natural hard.

The weldable brand is of the nature of the softest wrought iron and can be hammered as thin as paper when in a cold state, as shown by the branch of leaves at the top of Fig. 1, or it can be bent into any desired shape, and can be welded as easily as any of the iron products. It has the greatest magnetic permeability of any of the fusible irons and, therefore, is very useful in building dynamos for such pieces as pole cases, segments, etc. It is the most refractory of any of the malleable irons and this resistance to fire makes it useful where high degrees of heat are encountered, such as in the manufacture of carbides.

The medium hard is a low-carbon steel that is very tough. From it, complicated shapes, that are very expensive for a blacksmith to forge, can be cast and the metal is very dense, clean and true to shape. For this reason many parts of automobiles that were formerly made of bronze, malleable iron, etc., are being

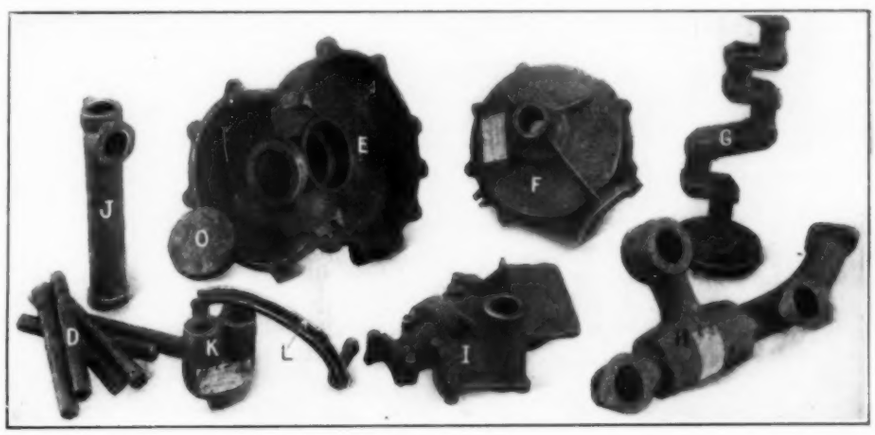


FIG. 4. AUTOMOBILE PARTS AND TOOL STEEL CASTINGS

made of this steel in Germany. Small gears, with 3/32 of an inch finish on the teeth, are molded in their proper shape, and large gears with ¼ inch finish, are also being cast. This does away with the necessity of casting steel gears in blanks and hence effects a saving in the machine work.

The natural-hard brand is one that can be hardened in a strong air current and it is, therefore, suitable for all kinds of cutting tools. This steel is specially adapted for manufacturing milling cutters, as they can be cast to shape, even to casting the teeth on, by allowing 3/32 of an inch for finish and then machining them. This saves all the labor now necessary to rough them out of the solid. Dies can also be cast to shape instead of forging them and working them out afterward.

Bars of steel are cast, with a very high tensile strength, that are [illegible] into steel wi[illegible] afterward drawn [illegible].

Castings for Automobiles

The thin sections in which this metal can be cast, and its homogeneity, makes the castings especially applicable to automobile work. A group of these automobile castings is shown in Fig. 4. Castings *E* to *L*, inclusive, are for such parts as were formerly either forged, made in malleable iron or bronze or cast of steel in much thicker metal.

Castings *E* and *F* are gear cases; *G* is a four-throw crankshaft; *H* is an exhaust manifold with a jacket to preheat the air taken into the carbureter; *I* is a steering-gear case; *J* a pipe connection; *K* an elbow; and *L* a lever.

The slab that is sawed off of a cast bar and shown at *O* is of tool steel. Numerous tests of this steel have shown an ultimate strength of from 85,000 to 100,000 pounds per square inch and an elongation of from 20 to 25 per cent.

One of the most interesting of these castings is *H*, as it is about 22 inches over all, and has a jacket cast around it that is 3/16 inch thick, 3¼ inches outside diameter, 6 inches long, and held in place by four ribs, on each end, that are ⅝ inch wide and 3/16 inch thick. The dimensions of this casting are shown in the line cut, Fig. 5.

Another interesting steel casting is the steering-gear case shown by *I*, Fig 4, and in the line cut, Fig. 6. This case is about 9¼x11¼ inches over all and the thickness of metal over most of the body is 3/16 inch, while at one end it is but ⅛ [illegible]. This has been cast in large quan[illegible] and perfect castings obtained.

Other Castings

[illegible] castings may

Small and medium-[illegible] process, easily be cast in wet sand by [illegible] thus saving the time consumed in [illegible] out the molds.

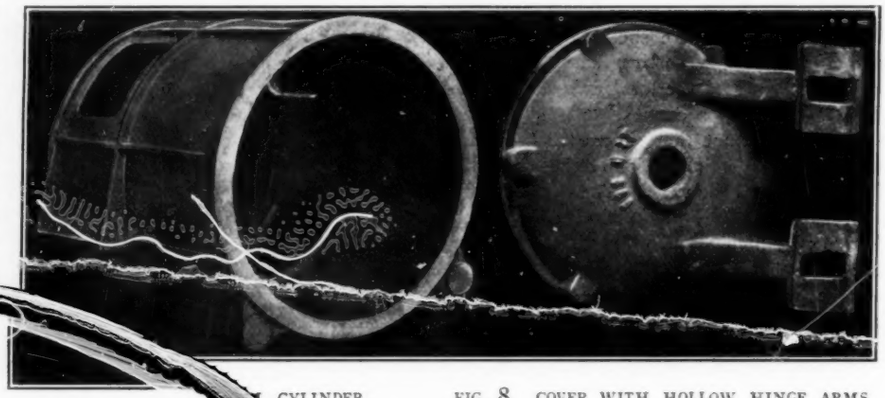


FIG. 7. CAST-STE[illegible] CYLINDER

FIG. 8. COVER WITH HOLLOW HINGE ARMS

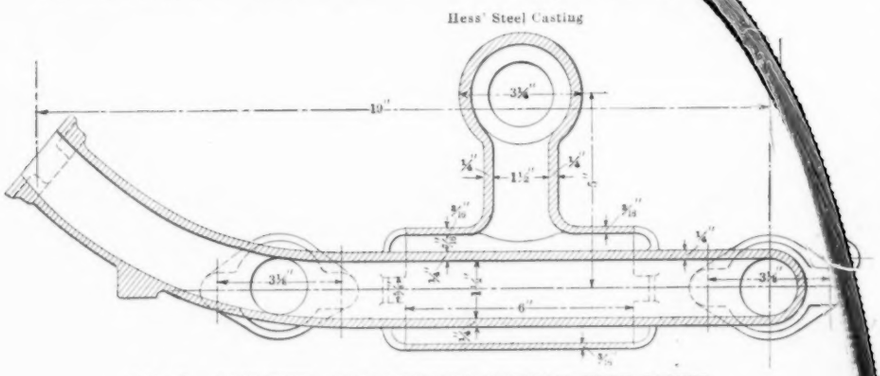


FIG. 5. CAST-STEEL AUTO EXHAUST MANIFOLD WITH JACKET

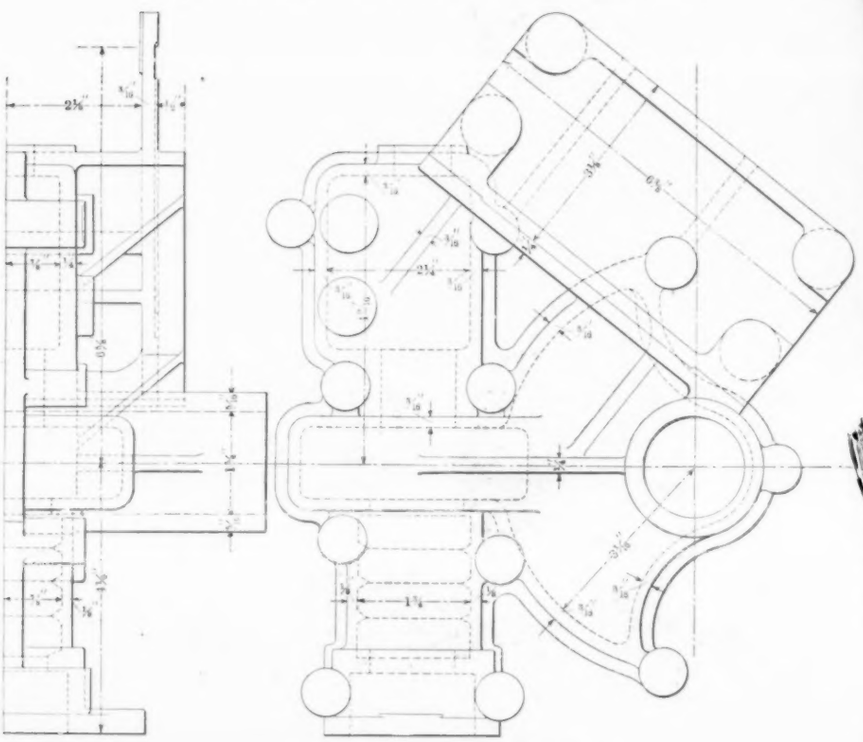


FIG. 6. CAST-STEEL STEERING GEAR CASE

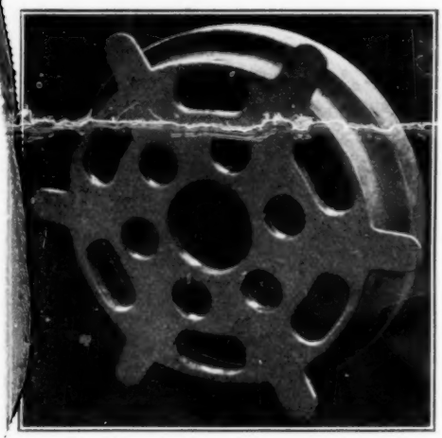


FIG. 9. THE COPE SIDE OF A CASTING

These steel castings have been successfully used in the pipe and tube industry owing to the feasibility of casting them in any desired bend or shape and obtain a smooth surface, such as has never before been attained in steel castings, as well as have the metal of the same quality as that in a rolled seamless pipe.

One casting that is being made for the German Government was formerly built up out of copper pipes, owing to its irregular shape.

The cylinder casting, shown in Fig. 7, is about 12 inches in diameter and 18 inches long and the steel is only ¼ inch thick, except in the flanges and feet. The cover casting in Fig. 8 has hollow hinge arms cast on it and the thickness of the metal around these is 3/16 inch.

The smoothness of the cope side of these castings and the freedom from pits caused by gas bubbles, slag, dirt, etc., is shown by Fig. 9. This casting was about 12 inches in diameter with a flat cope side, that was full of holes, thus making it difficult to carry away the bad metal with risers, as is usually the practice with ordinary steel castings, yet 3/32 inch was all that was necessary to machine off to reach metal that was free from any imperfection.

Salient Points for Inventors—Reduction to Practice

By John D. Morgan

What is reduction to practice? Reduction to practice is the final step in making an invention. When the inventor has accomplished this it does not require numerous diagrams and long explanations to show that the invention works. When it has been reduced to practice it speaks for itself. An invention which will not "go" is not an invention. It is only a failure. Unless the careful and ofttimes long and laborious work of the inventor when finally translated into metal or other substantial form will do the work for which it was intended, all that goes before counts for nothing. "Its possibility must become actuality" and "its practicability must be demonstrated by experience."

The inventor may have been absolutely certain from the start that his invention would work, and it may develop that when finished the invention will work absolutely as the inventor foresaw. But neither the business nor the legal world sees with the inventor's eyes, and so all that goes before, the conception of the invention, the careful experimenting, the sketches, the drawings, are merely steps toward this end. If he doesn't "arrive," the steps are in vain. If he does, every step was important in gaining that result. It is the reduction to practice that completes the invention.

It is true that the kernel of the invention, the spirit of it, is that which the inventor evoked out of his imagination, but it is equally true that that which makes it useful is the clothing of his idea in a material form. It is just like a man. His mind and spirit determine largely what he is and what he is able to do, but his body is what brings him into contact with the world and makes these powers of mind and spirit effective. So as the final step, the inventor is required to reduce his invention to practice, "in a word, the invention must be put into the hands of the public in a condition for immediate use, requiring no further speculation or experimenting, but fitted, as it is, for the accomplishment of its intended ends."

What It Does

But in addition to this, a reduction to practice does more. It fixes the rights of the inventor. He has completed his work. Nothing that anyone can do subsequently will take it away from him. An inventor may have thought out his invention carefully; he may have made drawings and written a description. He may have made experiments, or a model. There is a possibility that in spite of all this, some other inventor may enter the field and finally overcome him, but when he has reduced the invention to practice he is no longer progressing. He has arrived. After that no race can develop between him and another any more than there could be a struggle between two runners after one of them has passed the tape. It, therefore, relieves him of danger from rival inventors who thereafter enter the field.

What is Sufficient for Getting a Patent?

Fortunately for many inventors, the Government does not require that a man have built a commercial machine before they will grant him a patent. The extract from the law quoted at the beginning of the prior article in this series on "Making and Preserving Records," states that a patent will be given to "any person who has invented or discovered any new and useful art, machine, manufacture or composition of matter, or any new and useful improvement thereof * * *." The law does not state specifically that the final reduction to practice must be submitted to the Patent Office; it merely states that the invention must be new and useful, and that it be fully and clearly disclosed. The examiners of the Patent Office are men skilled in mechanical things and in the patent law. It has been the practice, therefore, to grant a patent to a man as soon as he has convinced the examiner, who is the one charged under the commissioner with passing on this question, that he has a new and useful invention. The drawings and description which are part of the application for patent are usually sufficient for the examiner to determine the usefulness of the invention.

On these facts the rule has been laid down that for the purposes of determining a man's right to a patent the filing of an allowable application is a sufficient reduction to practice. This is technically termed a "constructive" reduction to practice.

It is very fortunate for many inventors that this is the case. Many a man has possessed the ability and experience for inventing important and valuable machines. If he were required to build a commercial machine before securing his patent, it might be that the expense would be so great as to forever shut him out.

Which to Do

It is clear that a man frequently must use his own judgment as to whether he should build his machine first or apply for his patent first. Sometimes this question will not concern him for he may be so fortunate as to have the means to do both together. Frequently, however, the inventor wishes to go ahead as far as he can by spending as little money as possible, and each plan has certain features and advantages which it would be well for an inventor to consider. Knowing these, he is in a better position to decide which he should do.

If he decides to file an application for patent, he can usually tell within reasonable limits what the cost will be. This is frequently a no small advantage. This will also enable him to find out pretty definitely just what the scope of his invention is. That is, as to what is novel in his machine. The Government does not give a man a patent on his machine as it stands, but only on that which is new over what others have done before. This is one of the elements, but only one, which determines the value of a patent.

It is also an advantage for a man to get himself on record before the Patent Office. When he files an application the Patent Office becomes aware that he is an inventor in this particular art. If there are other inventors working along the same line, the office will notify him of this before it issues a patent either to him or to his rival, and will give him an opportunity to show that he is the first inventor and entitled to the patent. Another feature in connection with this is that the first man to file his application has a technical advantage, but an important one, in that the other man has to make his case against him. In legal phraseology, "the burden of proof" is on the later applicant.

On the other hand, an invention sometimes is easily manufactured. It may involve but little expense, or a man may be in position to do his own work economically and secretly. By secretly is meant not that he should neglect the recording in permanent and absolutely clear form his evidence, as pointed out in the first of these articles on "Making and Preserving Records." It means that he can do it without advertising it to the world, and thus inviting rival claimants. Some in-

ventors are over-careless about these things, but many more are over-cautious.

If a man is anxious to sell his invention, there is no doubt that if he has a machine built, it will often enable him to interest capital more quickly, or to get better terms. We might paraphrase the old saying, "money talks," and say that to many, especially those who are unfamiliar with drawings and who are not in the habit of thinking about machines, "machines talk." The actual working machine will make a practical and effective appeal to such persons which drawings and explanations and sometimes even a patent will not do. Where men with money must be interested, it will often be found that they are of this class.

As has already been indicated, in the broader sense, the actual working machine is the end and completion and fruitage of the inventor's work, and fixes his rights in all respects. This does not necessarily apply to another inventor working along at the same time, as will be more fully explained in the article on "Diligence."

Either One or the Other Should be Done

It will be clear that a general rule cannot be laid down as to which a particular inventor should endeavor to do; that is, whether he should apply for a patent first, or build his machine first in case he cannot do both at once. There is one rule, however, which should be remembered, and that is, he should do at least one of these things as well and as rapidly as he can.

How to Do It

First of all, a "model" is not necessarily a reduction to practice. On the other hand, a "model" may be a reduction to practice. It is not a question of whether or not a model is the same size as the commercial machine is to be, or whether it is made of the same material as the commercial machine, so much as it is a question whether the model will "do the trick." If the model is built merely to show that the movements are possible mechanically, it is merely a model in the eyes of the law. That is, it is a step in the development of the invention, but is not a reduction to practice.

On the other hand, if the first machine turns out the product or does the work, it does not matter that the machine is made of wood instead of steel nor does it matter even if the product is not as good in quality as is hoped for and expected from the final form of the machine. It is a reduction to practice in the eyes of the law.

The substance of the foregoing amounts to this: that while it may be desirable to build a model, if it is merely a model it is not a reduction to practice. Don't build the model as a necessary step in the reduction to practice. A model may be desirable, and even necessary, as in cases where it is a question whether several groups of mechanisms, or mechanical movements, each of which is operative by itself, will work together as a unity. Mechanical men well know that a machine is something more than an abstract thing, and that any given number of mechanical contrivances of any given type cannot necessarily be grouped together and run at almost any speed to produce a desired theoretical result. They know that a highly organized machine comes pretty near to having a personality, that at least it goes so far along these lines as to have preference and habits, and it would sometimes appear, fits of sulking and crankiness.

If a model is needed for these purposes, make it. If a small and cheaply made machine can be manufactured which will do this and will also do work, or turn out a commercial product, this is by far the preferable thing to do. Many an inventor has his final, elaborate, well constructed, durable and efficient machine so firmly in mind that he entirely loses sight of the possibility of the easier and cheaper reduction to practice. He may delay both filing his application and the building of the commercial machine and not once think of the easier way of getting a reduction to practice just indicated. He would do well to bear in mind that the difference between a model and a reduction to practice consists more in what it will do than in the way it is built.

Recording Progress

Some few suggestions as to the preservation of evidence of the progress made in reductions to practice, based on the previous article on that subject, will be in place. Orders placed for material with their dates should be carefully kept, and the originals are often accessible at the place of business of the seller. Frequently the records by the seller of the receipt of such orders constitute good evidence. Great care must be taken to connect the material with the particular machine. Shop time cards, dates of drawings, making of patterns, time and date of putting the work on a particular machine, and other kindred records have great value.

Frequently the inventor works alone and there are no shop cards and similar things. It is an easy matter, however, for him to have his friends make notes of progress from time to time. A brief memorandum signed and dated by the observer, as explained in the previous article will serve to clear and steady his memory should he ever be used as a witness. In this connection the camera is especially valuable. Photographs can be made from time to time, and these can be dated and signed by witnesses, preferably those who have a thorough understanding of the machine. Care should be taken to make the right views, and especially views which show clearly the parts on which work had been done between various photographs. Very little oral evidence is needed in support of records of this kind, merely proving the dates is usually sufficient, as the pictures will speak for themselves so far as the progress of the work is concerned.

In connection with evidence of the kind indicated it is sometimes wise to preserve some of the early products of the machine and these should be properly identified. The manner of doing this will be clear in view of what has already been said.

It is difficult to foretell what may be the possible importance (and also unimportance) of a particular patent, and the making and witnessing of pictures, as well as the other things indicated, are rather simpler in the doing than in the describing.

Resume

(a) The building of a machine is the final step in making an invention.

(b) For most patent purposes, the filing of an allowable application is equivalent to building a machine.

(c) A reduction to practice may sometimes be effected much more easily and cheaply than the building of the marketable machine.

(d) The real distinction between a "model" and a reduction to practice, in the law, is in what it does rather than in its size and material.

(e) With the foregoing information it is comparatively simple to determine what to do in a particular case.

(f) The preserving of record evidence should be carefully attended to.

(g) The camera is especially useful in recording this kind of evidence.

(h) It is well to preserve and properly identify the early products of such a machine.

In an interesting paper read before the last convention of the American Society for Testing Materials, it was stated in connection with the vastly extended use to which the alloys of manganese-bronze have been placed, that the automobile industry, more than any other, has set a high standard for materials which must stand up under its peculiarly hard service conditions. Automobiles with gasolene motors of 60 and even as high as 130 horsepower, at a speed of 1000 to 1500 revolutions per minute, and running over all kinds of roadbeds at 60 to 100 miles per hour, have stimulated the improvement of the materials entering into the construction to a very great degree. The nickel-chrome and other high-grade steels have produced results never heard of before, and cast iron has been wonderfully improved by the requirements of automobile cylinders. Likewise manganese-bronze, formerly used almost exclusively for warships, has been adapted to produce forgings and castings which will not crystallize or fail under the severest conditions.

Practical Letters from Our Readers

A Round Table Discussing Details of Modern Machine-shop and Drawing-office Methods, Practice and Economy

WE PAY FOR USEFUL IDEAS

An Adjustable Shrinkage Rule

It sometimes occurs when making patterns for pieces of an unusual form that the regulation rules for shrinkage do not apply. To meet such demands as this the device shown was designed, to attach to the ordinary 12-inch spring tempered steel scale to obtain any shrinkage up to and including 3/8 inch per foot.

The lower bar *A* is made the same thickness as the scale and is connected to it by the jointed part *B*, which is riveted securely to the bar *A* and the part *C* which is secured to the scale by the small flat-head screw as shown. Parts *B* and *C* are connected with the rivet *D*. This rivet is cut half away at its central part to allow the corner of the scale to come down to the center of pin or rivet.

The bar and scale are connected at the opposite end by the slotted piece *E* which is fastened to the scale with a screw in the same manner as the piece *C* and to the bar *A* by the nurled nut *F*. The holes in the scale for the screws are countersunk from both sides to allow both sides of the scale to be used and make available all of its different graduations. The adjustable stop *G* is pressed against the upper side of the bar *A* with a slight friction by the spring *H*. The thrust screw *J* bears against this spring when run in and clamps the stop firmly to bar *A*.

The finger *K* is clamped firmly by the nut *L* between the two plates of which the stop *G* is made.

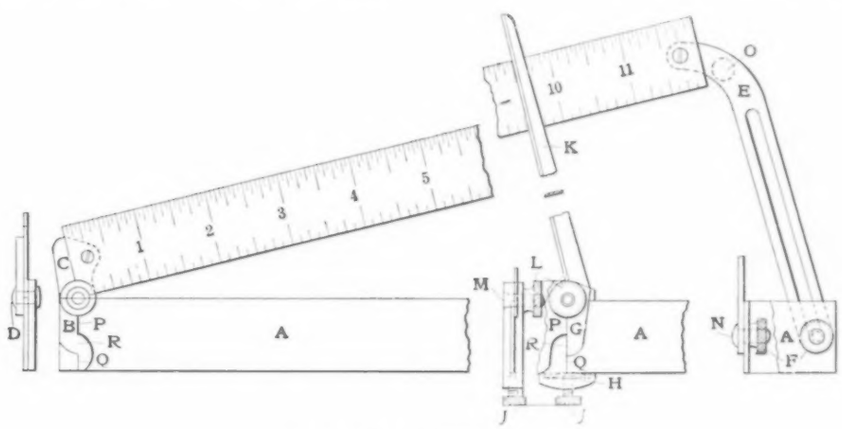
The stud *M* is cut away to its center line to allow the edge of the bar *A* to pass through the center of its diameter. The heads of the rivet *D* and the studs *N* and *O* make a three-point bearing for the tool to rest upon when in use upon the bench. The faces *P P* are inside faces, handy to take measurements from with a scale or with inside calipers. The small holes *R R* are to set dividers or trams from and the faces *Q Q* are to set outside calipers to.

To use the tool for a given shrinkage (say 5/32 inch per foot) set the face of the adjustable stop *G* 12 5/32 inch from the face of the stationary stop *B* and clamp with the thumb screw *J*. Move the scale to a position where the finger *K* will fit evenly across the end of the scale, then clamp nuts *F* and *L* (the finger *K* will spring enough to bear against the end of the scale). The tool is now ready for use.

Release thumb screw *J*, slide the stop *G* along the bar *A* until the beveled edge of the finger *K* coincides with the desired reading on the scale, then tighten the thumb screw *J* and the required measurement can now be taken from whichever of the three points indicated at *P*, *R* or *Q* are most convenient. If it is required to take measurements more than 12 inches long it is best to make gages one, two, three or more feet long plus the shrinkage and use one or more of them in connection with the above tool.

For convenience in setting to a required shrinkage the slotted piece *E* may be graduated and marked. The lines should come fair with the upper side of the bar *A*.

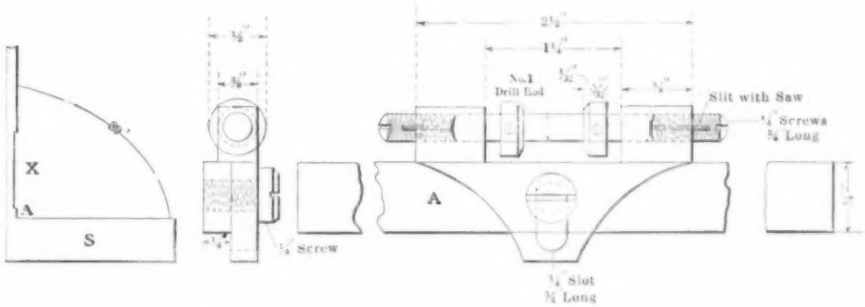
Watervliet, N. Y. MARTIN H. BALL.



ADJUSTABLE SHRINKAGE RULE

A Filing Fixture for Small Slots in Dies

The cut shows clearly the construction of the fixture. The bearings, end-thrust screws, collars, and No. 1 drill-rod roll are hardened and barely drawn down, but not to a color.



A FILING FIXTURE FOR SMALL SLOTS IN DIES

The collars are beveled down to within 1/32 inch of the roll so that the file will bear near the face of the roll. The end-thrust screws are case-hardened after slitting. If, after they are hardening it is found that they are closed, expand them enough to resist the friction of the roll when filing.

The bar *A* should be long enough to extend beyond the edges of the die in every direction; also tapped in several places so the roll holder can be shifted along either edge which should be straight.

When setting this fixture, clamp the roll at the back of the die using your eye for position, then place the die in a vise upon the surface plate, level the slot with a surface-gage indicator, then set the roll as much below as you want to relieve the die, using the indicator; or, if using a common surface gage place paper enough under the vise to raise it up the required amount for clearance, then set the roll to the surface gage, which must not have been altered for hight.

If your die is 1 inch thick, about 0.022 thickness of packing will give you 1 degree clearance, using the measurements given for this fixture. To set the collars I use

a square like *S*, which I file out of sheet metal thin enough to enter the slot, and the part marked *X* I file out so the square will touch at the angle *A* and the end.

The collars should be set a little closer together than the proper angle, then the end-thrust screws adjusted so the square just touches the collars on the side you are setting. This way of setting the collars gives you plenty of play endways, but holds the angle.

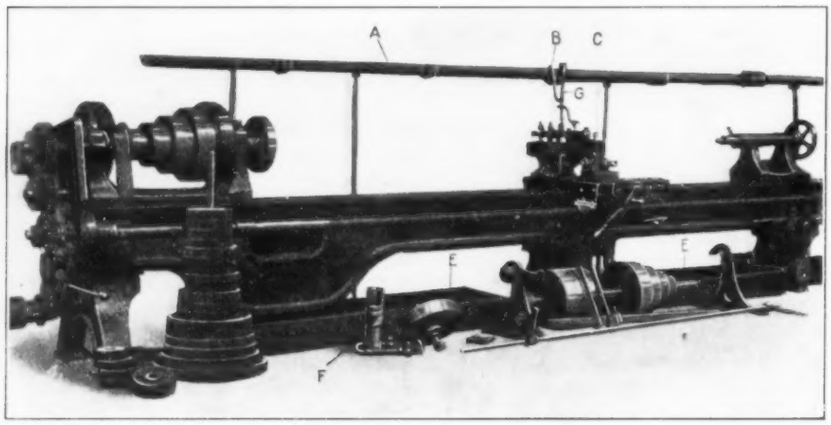
I use drifts made by taking a piece of drill rod strong enough to stand a fair blow, and grinding the end down lengthwise upon a 12-inch emery wheel; this gives a strong and easily made drift which I have driven through 20 slots 0.070x0.20 in a die 5/8 inch thick. The die steel was 1¼ inches thick, but where the slots came I drilled up half way in the back. This drift cuts about 0.005 on a side.

I coppered the mouth of the slot and then filed until I just brushed the copper off, bearing down upon the roll while filing. I also tapped out any slot that changed by swelling into the slot. We were punching bright rolled metal 0.065 thick.

Boston, Mass. SCOTTY.

An Old Lathe with a Novel Lubricating System for the Cutting Tool

The halftone shows a thirty-foot lathe which has been used chiefly for shafting and long screws. The machine was



A NOVEL LUBRICATING SYSTEM ON AN OLD LATHE

built between twenty and thirty years ago and on it is an ingenious system of lubricating the tools. The photo was taken to enable the present owners to sell the machine as second hand so possibly it will continue in action for some years yet.

A is a long half-round trough made from cast-iron pipes cut in two. It runs the full length of the lathe, each end being stopped to keep the cutting compound from running out. *F* is a plunger pump (driven from the countershaft) which forces the liquid up from the troughs *E E* (connected together by pipes) to the trough *A*.

Dipping into the latter is the bent pipe *B* connected to the delivery pipe *D;* the latter, of course, directs the lubricant onto the cut. At the upper end of pipe *D* is a small cup *C* under which is a cock *G*. The action of the apparatus is as follows: The compound is pumped up into the long trough *A* and then the bent pipe *B* and pipe *D* by siphon action, convey it onto the cutting tool.

I have never seen the machine in operation but assume that the small cup is used to start the flow. The cock *G* is opened and the vertical pipe *D* filled with liquid through the cup *C;* after which *G* is closed. When the nozzle cock is opened the lubricant which has been put into the pipe, runs out and sucks the liquid from the trough *A* up round the bend at *B* and down onto the tool. The overflow is taken care of by a pipe, screwed into the trough *A*, which allows the liquid above a certain level to run back into troughs *E E*.

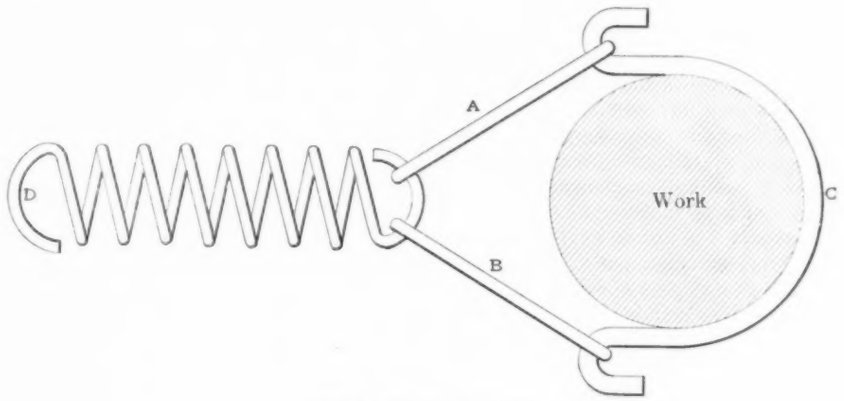
The simplicity of the scheme compared with the telescopic pipes, hose and reel, and other methods of carrying the lubricant to the tool, is very marked and altogether it is an ingenious arrangement which reflects great credit on its designer.

York, England. RACQUET.

An Anti-Chattering Device

The arrangement shown in the drawing is good, and needs but little explanation. The loop *C* is made of any size wire that will stand the tension of the spring at the small bends.

A and *B* are simply two links bent up from wire that is large enough to suit



ANTI-CHATTERING DEVICE

conditions and the same applies to the spring.

The device should follow the tool, being sure to use enough oil to thoroughly lubricate the shaft or work being turned, where *C* comes in contact with it.

By means of a link or other suitable arrangement, connect the end of the spring *D* with the rear end of the lathe tool or the tool post.

Occasionally where no follower rest was available I have seen a block of wood laid against the work opposite the tool to prevent chattering, and while in some cases it gives satisfaction in others it only aggravates the trouble.

This device has proved a wonder worker every time I have seen it applied.

Lowell, Mass. WM. B. HILLIARD.

An Expression for Change Gears

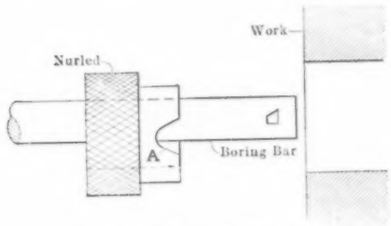
An expression for change gears, which I have been using with considerable satisfaction is *A* and *B*, driven; *C* and *D*, driving, instead of *A*, gear on worm; *D*, first gear on stud; *B*, second gear on stud, and *C*, gear on screw. I find that it shortens slightly the laying out of the work for the milling-machine hand, and that it is a form he better understands and is able to transform if the case requires. As, for instance, if the gears will not go together as laid out in the usual way, he recognizes at once that there is nothing sacred about the exact position of the gear and that the gear on the worm and the second gear on the stud may be interchanged if desired, or that any other change can be made so the two gears interchanged are both driving or both driven. He also recognizes that both the driving and driven gear may

be multiplied by the same number without altering their ratio, and will make the necessary changes to get gears that will go together, or that he has on hand, which is often quite a point in the many shops which do not have a full set of gears.

Rock Island, Ill. G. D. REYNOLDS.

Plug Gage Used on a Boring Bar

I had a number of pieces to bore out to a standard size, and to avoid the trouble of drawing the tool back in order to try the plug, I made the plug, as shown



PLUG GAGE ON BORING BAR

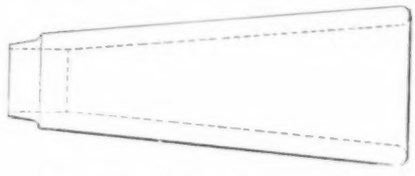
in the sketch, which I think will explain itself. It is just a plug nurled at one end and bored out so as to go over the boring bar with a good deal of leeway and cut away at *A* so as to clear the cutter when trying the plug.

Waltham, Mass. H. A. SHAWFUS.

Putting Cork Inserts Into an Automobile Clutch

A man's first attempt to put cork inserts into an automobile clutch or brake generally reduces him to a state bordering on anarchy. It is worse than driving a pig or putting up stovepipe.

With the little tool shown in the sketch there is no trouble. The lower end is turned to a slight taper, and at the extreme point is just small enough to enter the cork recess. It is bored straight back for about ⅜ inch and then tapered out, as shown in the line cut. The lip, at its edge, is not more than 0.015 inch thick. It



TOOL FOR INSERTING CORK INSERTS

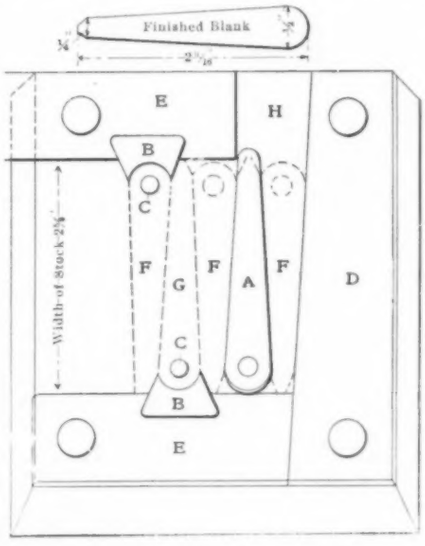
is made of tool steel, hardened, and drawn at about 550 degrees Fahrenheit, then polished nicely inside.

To insert the corks, soak them in very hot soda water for a half hour; drop a wet cork into the tool; set the lower end into the recess; hold it down hard, and drive the cork down solid into the recess by using a brass, not steel, rod for the driving.

Detroit, Mich. ROBERT G. PILKINGTON.

Cutting Two Blanks at Each Revolution

The accompanying line cut is a sketch of a blanking die which I recently made, to cut out two blanks of 16-gage material at one revolution of the press, and as it worked to perfection I submit it to the readers of the AMERICAN MACHINIST. The sketch shows the die with the stripper plate removed. The heavy lines show the openings made in the die for punches *A*, *B B* and *C C*. *D* is a stop made of machine steel, case-hardened. *E E* are gages for the stock to slide between under the stripper plate. *F F F*, in dotted lines, represents the first blank as it is operated on until it slides off the die through the gap *H*, between stop *D* and gage *E*. *G* in dotted lines represents the second blank until it is blanked through the opening *A* in the die. Opening *A* in the die is made a little longer than the blank *G*, so as to overlap the ends, and let the punch that fits into opening *A* cut



DIE FOR CUTTING TWO BLANKS

only on the sides. Punches *B B* should be ground along the line of the gages so that their backs can enter the die before their fronts cut the stock. This die works best in an inclined press, as then blank *F* can slide off the die.

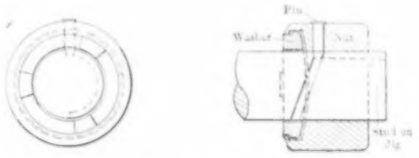
To operate, insert the stock between the gages far enough for punches *B B* to cut a half moon out of each edge and perforate the small hole *C C* with the first stroke of the press. For the second stroke of the press advance the stock until the perforated hole in blank *G* comes in line with the pilot that fits into opening *A*. This will cut blank *G* through the die and let the scrap from the end of the strip slide off the die through gap *H*. Now advance the stock until it strikes the stop *D*, and with the next stroke of the press you will cut two blanks, one going through the die and the other sliding off through gap *H*.

Racine, Wis. J. C. GRAHAM.

Combination Nut and Washer

This arrangement is intended for use on jigs, fixtures, and the like, where it is necessary to have a removable nut on a stud to bind work. The action of a solid nut against a piece that has not been faced with the hole is: the nut only bears against the high side of the face on the work, and if the piece has been faced and a nut without a washer is used to clamp it a twisting or turning action is set up.

It is not desirable to use an ordinary washer to obviate these troubles as the use



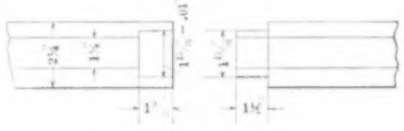
A COMBINATION NUT AND WASHER

of another loose piece lessens the utility of the jig or fixture. The device illustrated overcomes these difficulties by combining the nut and washer. It will be seen that the nut has a concave surface, and the washer a convex with a shoulder on the front side so that the flange left on the face of the nut is spun over; this prevents the washer from falling out, while leaving it free to turn. Immediately the washer comes in contact with the work it ceases to turn, and aline itself to the face of the work. The pin in the nut moves in a spiral groove on the stud until the piece is firmly clamped.

Poughkeepsie, N. Y. DESIGNER.

Tube Welding Kink

Here is a little experience I had a short time ago, in the way of tube welding: An order came along for two mild-steel tubes, finished 12 feet long by 2¼ inches outside diameter, 1⅝-inch bore and polished. The longest we had in stock were a few 11-foot lengths and some short pieces, which had previously been cut off other lengths of the same size tubing. These we decided to try to weld. There-



TUBE WELDING KINK

fore, two of the short lengths were taken to the blacksmith who was asked to try his best to secure a good weld, but he failed to make one length out of two. I now thought it was my turn, so I obtained two more short lengths from the stores, took them to a lathe hand, and had them turned and bored, as shown. One was then shrunk onto the other.

This was then put in the smith's fire and brought carefully to a nice welding

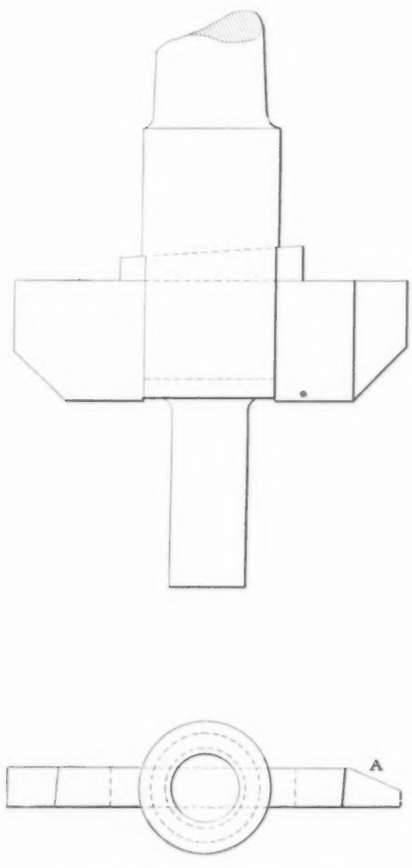
heat; then placed on a flat plate, and given two sharp blows with the hammer, which finished the job as far as the smith was concerned. When cool it was taken back to the lathe hand to trim the weld up; when this was done the joint could not be seen. I, therefore, proceeded on similar lines to make up the long length, which proved to be satisfactory in every way.

JOHN SUTHERLAND.

Nottingham, Eng.

An Improved Facing Tool

For refacing the brass valve seats of a duplex pump, at the Artisan school, it was not deemed advisable to make a regular mill, so the foreman suggested the tool shown, except knowing the inclination of such a tool to chatter, particularly in brass, I suggested making a drawing out of one



AN IMPROVED VALVE FACING TOOL

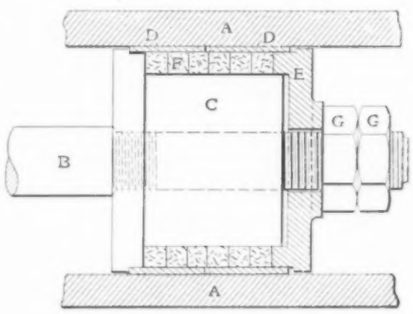
end, as shown at *A*, and it worked like a charm.

It was applying the same principle we used some years ago in making taper reamers. A left-hand spiral with increased twist is all it takes to make a reamer that will cut free and not chatter, except in thin stock. So far as this principle is concerned, it can be applied to many tools, face mills, for instance, to advantage.

JOHN E. SWEET.

Packings for Hydraulic Pistons

The principal requisite of rolling-mill design is that a part shall be so constructed as not to break under any circumstances, and in case an accident should occur, it must be built so that repairs can be made in the shortest possible time. Hence in walking through a mill you will see proportions which appear unscientific to the average engineer not familiar with the shock and stress of mill work. I will not say that his verdict is entirely at fault, for shocks and stresses occur in the daily operation of the mill which very often cannot be calculated upon.



PACKING FOR HYDRAULIC PISTONS

The present mill as you see it today is the result of accumulated experience obtained from years of experience with breakdowns. Not only are parts made heavier than would seem necessary, but many designs are practically forbidden to be used on account of their inability to withstand the wear and tear of mill work.

Among these you will find the internal-packed double-acting plunger. It is shunned even at the expense of making two opposed outer-packed cylinders, which doubles the cost and floor space required.

Now in some rare cases, on account of lack of space or conditions forbidding the use of two opposed cylinders, a single double-acting cylinder must be used, and unless its packing is of a special design it will give no end of trouble, and according to its location may be a very costly apparatus.

There is, however, a design of packing not familiar to many engineers which, after a thorough trial in a rolling mill, has proved satisfactory, and given results never obtained from an internal-packed plunger.

A glance at the linecut herewith will explain the packing. *A* is the wall of the cylinder. *B* the rod screwed into the plunger *C* which is made of brass. *E* is a cast-iron washer which jams the packing by tightening nuts *G G*. *D D* are two brass rings which are split on an angle the same as a piston ring, and are forced against the cylinder walls by the packing, which is of the usual hemp variety. This construction gives a plunger that for wearing qualities and for tightness of packing is hard to beat. The packing itself does not rub on the cylinder walls, and has practically no wear to it; also it is practically impossible for it to blow out.

Of course this design is not limited to mill work, but will be found to give entire satisfaction anywhere that constant blowing out of the packing has occurred.

Altoona, Penn. R. B.

Pattern Drafting

One of our men got an article to make similar to that shown in Fig. 1. It was a fancy lamp base made up out of strips of metal soldered together on edge. The way he did was to cut a templet the same shape as the required curve *F*, with the back edge square to stand up. Then judging the length of the strip, he soldered it to the templet, marked on the strip the known sizes top and bottom. Then he would hold it against an angle plate and file away and fit until he got the piece to touch all the way along. This was tedious work and the results were far from being accurate.

Fig. 2 shows a method I devised for developing these pieces. The required curve is described, as shown, using as a base line a line drawn parallel to the center line of one of the pieces. This curve is divided up and the points projected to

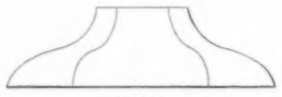


FIG. 1

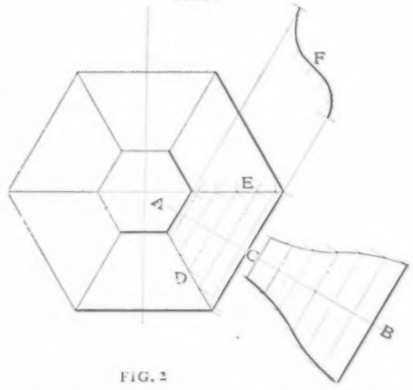


FIG. 2

METHOD OF LAYING-OUT A SHEET-METAL TEMPLET

the edge lines *D* and *E*. The distances laid off on the curve are then laid off on the "stretchout" *C B* and the points projected in the usual way. The plan is, of course, drawn first. It is evident this method may be used for any similar figure where the diameters are numerous; that is, where the figure goes smaller and larger in several places; the largest diam-

eter should be followed in drawing the plan.

Hamilton, Ont. W. HUTCHINSON.

A Quickly Made Die

Did you ever have two hundred forgings to get out as quickly as possible, all of them to be like twin sisters, and find out at the last minute that you had only your two hands and eyes to go by, when a die for the work would help you get them out in one third the time, but it would take at least two days to get the die?

Such was my fix recently when I had an order for 200 goose-neck carpenter bars. It is no easy job making the claws all alike, by hand, and a die is the only means whereby they can be made to come uniform. Therefore, a die I had to have of some kind, so after much thought an idea suggested itself whereby that two days' die work could be cut down to two hours and the whole job cut down two-thirds in time.

A piece of 1⅛x2½-inch scrap steel, just right for my purpose, was obtained from the scrap pile. I then made an exact model of the finished end or claw, as shown in Fig. 1. Then I ground and polished it nicely, so it would leave a good clean impression in my die. I next turned a gib on my piece, as shown in

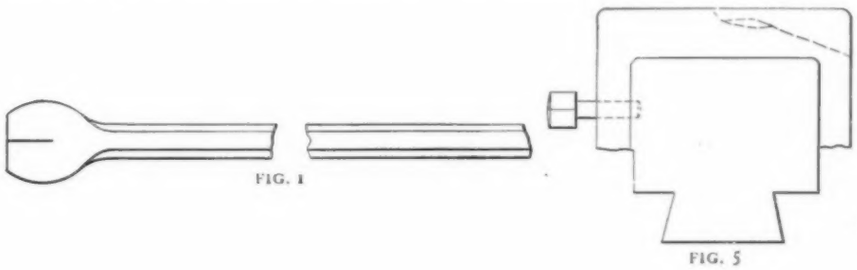


FIG. 1

FIG. 5

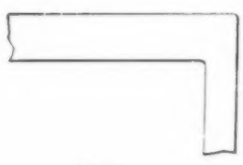


FIG. 2

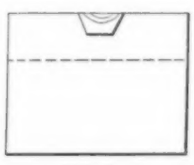


FIG. 3

FIG. 4

A QUICKLY MADE DIE

Fig. 2, being careful not to work a cold shut in the bend. After this I sank a smaller fuller in the piece, on an angle, as shown in Fig. 3.

The next operation was to make the piece as hot as it would stand, brushing it off quickly with a wet stubby broom, and hammer the model bar down into it, even with the surface. I then turned the other gib, as shown in Fig. 4, and fitted it to a flat-bottom die block, as shown in Fig. 5. A hole was then tapped out for a ¾-inch set screw to hold it firmly to the die block. A quarter of an hour of scraping and filing and I was ready to form the 200 claws, in one hour's time, by heating them in a coke furnace. I find there are many shapes that can be formed in the same manner under a steam or Bradley hammer and the die is an economical one that can be quickly made. Of course it does not put a finish on the forging like a machine die, but this was not necessary as I had two other heats to take on the end which would have marred the smoothest forging possible to get out.

St. Louis, Mo. T. TOOT.

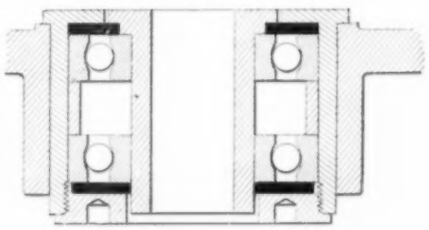
Wear Proof Drilling Jigs

It was Ben Akiba, or some worthy of the Old Testament days to whom the well worn "There is nothing new under the sun" was first attributed, so far as history or legend records, though no doubt he was only repeating an ancient platitude.

For all that, I believe that on a recent visit to a Middle Western shop I did run across something new. The superintendent called my attention to certain high-speed drilling and boring jigs with the remark that as I had ball bearings to sell, these jigs ought to be of interest. A closer examination showed that the bush was made of two parts, the inner of which rotated with the drill. This inner part was mounted on a ball bearing. To my remark that that was quite interesting, but that the reason was not apparent, the rather astonishing reply was made that the arrangement was more than justified by the longer life of the jig and the maintenance of the original accuracy. Going more into details, it was stated that the ordinary bush wore sufficiently in two to three months to require renewal; the ball-bearing bush had shown no appreciable wear within two years of constant use. It was also found that the wear of the bar itself was eliminated. The result is natural enough; the ordinary bush wears in direct ratio with the speed of the tool passing through it; such speed is made up of the rotation and the feed. The feed is so small an element as to be negligible. In the ball-bearing bush there is no speed due to rotation of the tool in the bush, merely the very slight motion and wear due to the feed. The rotary motion is transferred to the ball races. As I have ball bearings carrying grinding spindles at many thousand revolutions per minute, grinding holes to a limit of 0.0001 inch without developing wear in a year's continual use, it is clear enough why in this much less severe work of the drilling jig wear is eliminated.

Some time after this visit it occurred to

FIG. 1



BALL BEARING BUSHINGS FOR JIGS

me that the readers of the AMERICAN MACHINIST might be interested; a request for permission to publish this improvement was gracefully acceded to, but with a request to not mention the shop.

Without recollecting the details of the jigs shown me, Figs. 1 and 2 give designs that will be satisfactory. In Fig. 1 a short bush is mounted on a single ball bearing, while in Fig. 2 a larger bush is carried on two bearings. The latter design is recommended as best, since the rotating inner part of the bush is more definitely lined up and cannot rock at all.

The inner bush is of steel and hardened, and is a light drive or press fit in the ball bearing. While the other race of the ball bearing may be directly mounted in the body of the jig, I think it better practice to interpose a bush, as shown; this bush need not be hardened, since it is not subject to wear. A felt washer protects the bearing against dirt and chips. The collars of the bushes should come very close with a mere running clearance to more effectually prevent the dirt reaching the felt. Whether the bearing is also protected by a felt washer at the lower end depends upon the character of the work; it is decidedly advisable if the jig has several holes in different sides, requiring that it be tilted; in such a jig the dirt may fall into the bearing from the inner side as the jig is reversed. In the two bearing bushes the two outer races are separated by a distance sleeve and all parts held together by the nut shown.

Philadelphia, Penn. HENRY HESS.

Discussion of the Previous Question

Letters from Our Readers Showing How Many Men of Many Minds Look upon Various Subjects Opened up in Previous Numbers

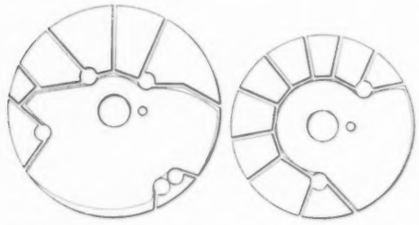
WE PAY FOR THESE ALSO

Making Automatic Screw Machine Cams

I read with interest an article on page 719 by Thomas A. Dicks, describing the method he used in cutting cams for the Brown & Sharpe automatic machine with a hand saw, and finishing in the filing machine. First, I note an error in the thickness of cams that might be misleading, probably due to the printer; 5/8 inch instead of 3/8 inch.

I find many different ways of making; several were shown in AMERICAN MACHINIST using the index head for the raise on lobes. Others have special machines. I visited Brown & Sharpe's shop and saw them rough them out with a 5/8-inch square punch and die in a press. The toolmaker allowed the press to run without stopping while he guided the cam under the punch, keeping a reasonable distance from the layout. This was certainly the fastest roughing out I had seen or heard of. A common method is to drill holes all around the layout and break the pieces off; then file, or mill and file. The latter I never approve of, as it is too expensive.

I cut a few sets for the No. 2 machines; after laying out I drilled the necessary 5/8-inch holes at the rotating and raising points; then put them in the milling-machine vise, holding upright and using a



MAKING OF AUTOMOBILE SCREW MACHINE CAMS

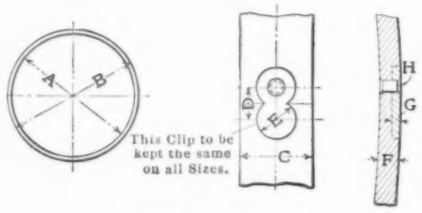
1/8-inch cutter about 4 1/2 inches in diameter, cutting the piece off, as shown in the sketches. Then changing the cutter for a side cutter, feeding in the carriage and raising the table to guide the cutter around the lobes and changing the cam in the vise as often as necessary without any close setting. Then the cams were ready to file. I never liked much filing, and here is the point I wish to bring forward: I took them to the Besly disk grinder, got a good wheel and squared the adjustable rest. I worked them right up to the lines and had them finished square with the face. It took 20 minutes to grind the set; filing was not necessary only for looks, so I draw-filed them. To drill, mill, mark, grind, file and harden in cyanide took less than five hours for the set.

W. M. McKENZIE.

New Rochelle, N. Y.

Ring Oilers

On page 493 you publish an account of a ring-oiling device, its failure and remedy. Evidently your correspondent thinks that the idea of an oil ring in halves is



A SPLIT OILING RING

new; however, our firm has used a split oil ring on all bearings for the past five years. We have yet to hear of one failing to do its duty. The man who designed the ring (the one that failed) as shown by your correspondent must have been a novice at his work, or he would have known that the ring, apart from being far too heavy, is also of the wrong section. A ring of the section shown would tend to drain the shaft of oil instead of feed it.

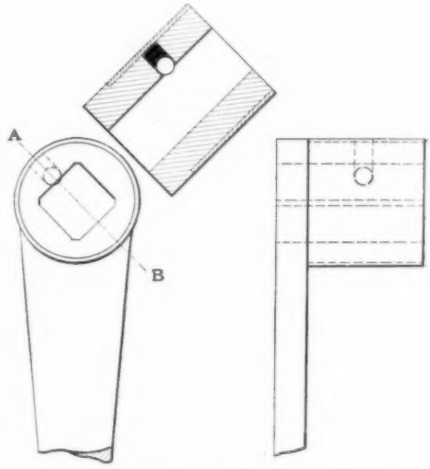
Referring to the dovetailed ring as fitted to replace the old one, the main fault lies in the dovetail passing through, thus making it possible for the ring to collapse, which would again bring disaster. The method adopted by us is shown in the accompanying cut. The weight of the ring has also been taken into consideration to get the best result. They are made of brass, cast in blocks, bored, turned, and parted off on the boring mill, sawed through on the miller, and drilled in a small jig which slips on the end of each half. The clips are of steel, one fitted on each half and riveted. These are milled by a special cutter in two operations, a gross costing a few pence only. When the clips are riveted on, all that is required is to put a clip on one-half into the recess of the other, then spring the other clip into position. This gives a firm ring, and no fear of the halves jumping apart.

Nottingham, England. OBSERVER.

Questions for the Designer

On page 560 there appears an article on the above subject in which Mr. King instances machine vise handles which fall off the screw, and dent the machine table; this, as he says, is caused by the loose fit of the handle and the vibration of the machine. As these handles must be an easy fit to allow of their being quickly shifted from one position to another, it seems to call for some device such as is shown in the cut herewith.

This was fitted to the handle, on an English lathe, which had a habit of falling off onto the operator's toes. Having no liking for bruised toes he cured the handle in the following manner: A hole 0.187 inch was drilled in the boss of the handle in the position shown, then with a breast drill the position was transferred to each of the four flats on the pin. The handle was removed and the centers were drilled a little deeper. The hole in the handle was not drilled right through the full size of the drill, but enough stuff was left to



TO PREVENT MACHINE HANDLES FALLING

retain a steel ball 0.187 inch, which was then inserted; a piece of rubber was next put in, as shown by the heavy shade.

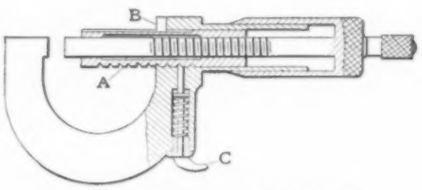
This being done, a piece of tube was driven on the boss and the job was complete. A section of the boss on the line *A B* is shown with the ball and the rubber held in place by the tube. This was so successful that it was soon applied to other handles in the same shop. No amount of vibration will jar it off, and yet it comes off quite easily when needed.

WILFRID GEORGE.

Birmingham, Eng.

A Quick Adjusting Micrometer

I would suggest that the quick-adjusting micrometer shown in the AMERICAN MACHINIST on page 579, might be made more substantial in the following manner: Extend the nut *A* to form a sleeve about the measuring spindle, a small key



QUICK ADJUSTING MICROMETER

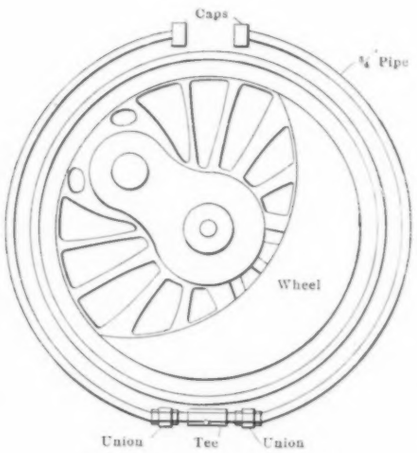
B keeps the nut from turning and the notches for the locking plunger are cut in the under side of this sleeve.

Philadelphia, Penn. W. ALTON.

Taking Off, and Tightening Locomotive Tires

It may interest some readers on the subject to know that it is not necessary to take the wheels from under a locomotive to replace the tires, or to tighten loose tires. I show a cut of a wheel with ¾-inch pipe bent to fit wheel coupled with ground joint unions and tee in center to connect gasolene tank. The pipe is drilled all around under the side with a row of small holes to let flame come on the tire all around, the holes being drilled 3 inches apart.

While we did not make any better time



HEATING LOCOMOTIVE TIRES

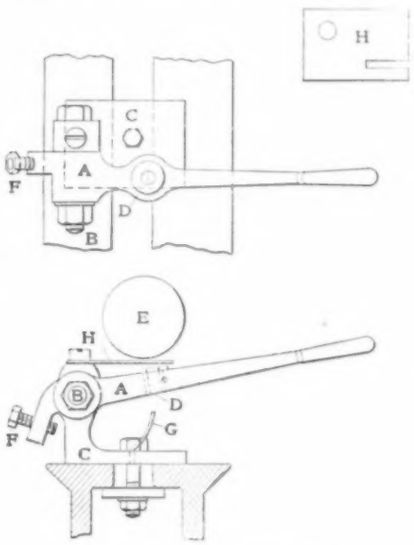
than Mr. Koster, three men and I took off eight tires and put on eight new ones in eight hours, but did not connect the side rods. We used a 20-gallon gasolene tank with air attachment. While the tire on No. 2 got hot we put on No. 1 tire.

Where tires get loose, I use the same rig to heat them, jack up the side of engine and take weight off the collar of box, then put in thin strips of tin between the tire and wheel and up the side as far as possible, then drive wedges under the tire on the rail and put tin in top and sides; after they cool they will be tight and stay so a long time, sometimes running until they have to be replaced with new tires.

Orange, N. J. S. T. KELLEY.

Screw-slotting Attachment for the Lathe

At page 530 H. D. Chapman describes a screw-slotting attachment for the lathe which involves a considerable amount of work in the making. The attachment shown in the accompanying sketch is applied to an old lathe, and consists of a handle *A* pivoted at *B* to the strap *C*



SCREW SLOTTING ATTACHMENT

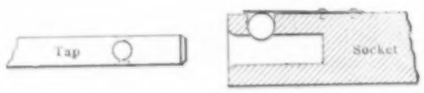
which is fastened crosswise to the lathe bed. At *D* is a hole to receive bushes having holes to fit different sized screws. In practice the screw is dropped into the bush and the handle *A* raised until the screw head touches the slitting saw *E* running between the lathe centers, the hight being governed by the adjustable stop *F*. On lowering the handle *A*, the screw is automatically discharged by the pin *G* and drops into a box. In this simple attachment no time is lost by fastening in the screws, the latter being held stationary by the sheet-steel spring *H* pressing on them while being slotted. The spring *H* is cut to clear the saw, as shown in the detail, but is omitted from the plan view for clearness.

The convenience of this handy appliance will be appreciated by anyone having much slotting to do.

Leeds, England. G. J. T.

Tapping Fixture for the Drill Press

The fixture described by E. A. Dixie on page 426, is practically the same as that used on the four- and six-spindle nut-tapping machines, except that in these machines the squared shanks of the taps are notched



TAPPING FIXTURE

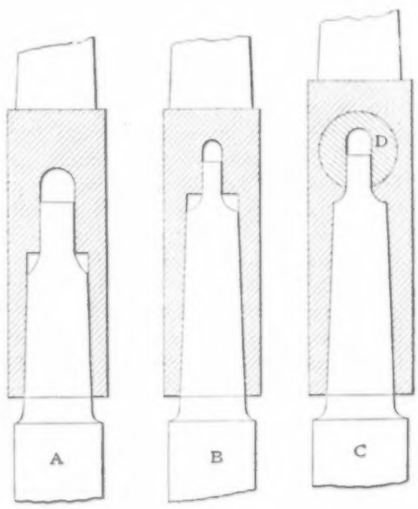
with the point of a drill so that the steel ball holds them in more firmly and yet allows them to be pulled out by a quick jerk while in motion. This is necessary because fifteen or twenty nuts are allowed on the tap shank before it is emptied and unless it was held in some such way the weight of the nuts would pull the tap out of the spindle as it lifted.

The shanks of the taps are notched on all four sides so that no care is needed in replacing them in the spindle. The accompanying cut will show how they are made.

Decatur, Ill. ETHAN VIALL.

Using Drills with Broken Tangs

We used to have lots of tangs twisted off so I used to turn them and put a fresh tang on, which was expensive. I then



DRILL SOCKETS

made special sockets as shown at *A*. I show one of the standard No. 3 sockets at *B* to compare my alteration to the new socket.

In the new socket shown at *A* the taper is bored shorter and a new tang is ground on the drill. We also had trouble with the tangs cutting the cotterway in the

socket. The socket as shown at *C* was drilled clear through and the tempered tool-steel piece *D* was driven in. These have been in use a long time and show no signs of wear.

New Castle, England. TYNE.

The Personal Equation

I was much interested in Osborne's story of Sammy's troubles with the systematic clerk. The apparent antipathy of the shop men toward the new departures coincides with my own experiences. But the inference which I drew—that Charley was dismissed from the service—was very disappointing to me.

It strikes me that Sammy was secretly patting himself on the back exclaiming the while "You are the diplomat who could have inaugurated a system without this friction and consequent loss of good feeling among the men, but you are so busy with weightier matters you really haven't the time to spare." In reality he showed signs of considerable weakness as a diplomat through his inability to pick the qualities of Charley, the blacksmith and the fellows who quit; he did not know why. To my mind one of the first requisites of the superintendent or proprietor, as Sammy appears to have been, is to be able to pick these qualities in his men.

Now the day the blacksmith came in, with his howl for a list of sizes to be kept in stock, was the day the discerning superintendent would have decided that this blacksmith was not the man to have the ordering of material in charge. He showed pretty conclusively that his personal feelings were of considerably more importance, to him, than any of Sammy's interests, even if he was drawing his salary from Sammy's till, and it was a pretty safe bet even that early in the game that he was an obstructionist. He may have been valuable as a blacksmith, and as such might have been retained, but the ordering of material and the carrying out of any other extensions of the systematizing process were most decidedly out of his line.

Now I feel from what little I am able to gather from Osborne's letter of Charley's personality that he was one of those rare individuals who was really interested in the plant, and could glory in its success to a greater extent than simple self-aggrandizement. He was seemingly conscientiously interested in his work, and could lose sight of self, for a little while at least, as evidenced by his attempt to introduce some semblance of system; for if he were broad enough to conjure a system he showed evidence of being a reasoner and as such would readily see that as the system spread, individuals, as such, would be lost sight of; he with the rest. He seemed to possess qualities worth paying a salary for. He was not always right; Sammy probably could not have paid a requisite salary had he been so. The qualities he gave evidence of possessing are so rarely met with that they should be carefully nourished by any superintendent. I deplore the fact that Sammy missed such a good opportunity to slap a wet blanket on those little jealousies which so frequently crop out, especially in the smaller shops where acquaintanceship is general.

A rule I have worked by for many years has been to appear not to notice in the least even the broadest hint of any irregularity on the part of any employee, when brought to my attention by any of his shop mates. I aim to leave each man with the appearance of taking it for granted that he is so vitally interested in the advancement of the shop that to neglect the slightest detail were well nigh impossible. I rarely give an order. I try to put them in the form of requests. I find it works out well and makes it more pleasant all around.

My way of dealing with Mr. Bsmith would have been to have said something like this: "Well, now John we will not worry about this matter. Let things go along as they have been for awhile and at the first opportunity I will have you up again, and we will have a conference with the office men and see what can be done. We are getting bigger and must systematize to a considerable extent. We don't want to be back numbers and the office men are trying their best to cope with the situation. We will all get together soon and see if you can't help us out." I think Bsmith's pride would have been touched a little and he would not have had the satisfaction of believing he had Charley's scalp within reach, and so would not have allowed his animosity toward Charley to bring him to the point of quitting a good job.

I believe every shop must, to a great extent, work out its own system, using what can be used from the systems of others, but having no fear in taking the initiative. But of this rest assured; no office man can work out your shop system for you. Neither can your foreman if taken alone, but he can come a great deal nearer to it than a clerk. The right thing is to get your shop man and office man together. Invite them to frequent conferences. Don't be afraid they will beat you by spending an occasional hour in your office during business hours. They may be earning double salary while there.

Erie, Penn. V. BARR.

I have read with much interest the various articles on this subject, printed from time to time in the AMERICAN MACHINIST. Mr. Osborne and those that have commented have taken a stand against Charley and his system. Perhaps in this particular case the system was a bit overdone, but at the same time it hardly seems to me that this shop was run on a very business-like plan.

Mr. Osborne said that the blacksmith's work was not done under conditions that make it convenient to write at all times. If the blacksmith had kept a small memorandum, and jotted down his needs as they arose during the day he would have been able to send a complete list to the office at night, or when necessary to order, and thereby have avoided the chances he took in the old way. With conditions as they were in this shop, where everyone and anyone ran the requisition book, etc., I doubt if it would grow very rapidly into a modern, uptodate plant. Of course, to such a shop the introduction of a system meant a sort of a revolution—and yet in the end one would prove beneficial, and certainly would be needed as the shop increased in size. If a large factory, employing between 4000 and 4500 people, had no system, what kind of a shop would it be?

So I do not think the fault was so much with Charley's system as with his overbearing manner. For apparently Sammy found it impossible to do without more system than he had had, though he could do without Charley.

Then, on the other hand, the blacksmith was undoubtedly wrong also. It is quite natural for men to get into a certain rut after working at one position for a number of years, and to be jogged a little disagrees with them; it seems to me that this blacksmith was one of these.

System is very necessary to a busy factory, but at the same time to introduce a system requires patience not only by the one introducing it, but by all concerned.

Buffalo, N. Y. JACK MERWIN.

Chamfering Washers

The discussion of the previous question pages is always interesting because of the different methods of doing the same piece of work. I was particularly struck in this respect by letters on chamfering washers from James Klein, Wilfrid George and C. Petitjean, which have appeared recently. These go to prove that our methods are generally governed by the available plant. One used a drilling machine, one an engine lathe, and the other a turret lathe.

The best method I have seen for doing this operation is the one in vogue in a large shop in the Midlands, where they took up the manufacture of bright washers to use up scrap cold-drawn steel. This firm (who, by the way, advertise in the AMERICAN MACHINIST) when they started to make the washers, used to put about 60 on a mandrel and between every other two put a washer of smaller external diameter, and screw the whole up together. Then after taking a water cut over the top, the boy with a tool like a screw-cutting tool, would chamfer each pair at once. This was a very cheap way of doing them, but their present method is both cheaper and better. They put the

chamfer on with a press and turn the diameter as before. This method gives a washer with a good appearance and not scratchy like the turned chamfer.

WALTER G. GROOCOCK.

London, England.

Should Not Technical School Shop Courses be Reversed?

I was particularly interested in reading the article under the heading, "Should Not Technical School Shop Courses be Reversed," which appeared on page 715. I am in sympathy with Mr. Harris' ideas in regard to the mechanical courses taught in technical schools. But I think the idea equally applicable to commercial life. There is no doubt about its taking a man with as good an education, intelligence and greater thinking capacity to be a good patternmaker than it does to be a good machinist.

But does it take a man with more brains, thinking capacity, or better skilled in the use of tools to cut, carve, glue, and build up a pattern piece by piece than it does to forge a complicated piece of iron or steel work from the solid? Mr. Harris says in his article that a like line of thought would lead one to believe that the blacksmith was one ahead of the machinist. This can be proved beyond doubt.

I fully appreciate the importance of the patternmaker, the machinist and all the other classes of mechanics who do their share in the construction of machinery. Without depriving any class of mechanics of the credit due them the blacksmith may be placed at the head of the list. It must, however, be admitted that there are comparatively few good blacksmiths, considering the number employed. But it is surprising that there are any when the treatment that is usually meted out to them is taken into consideration. Still, he has to take the product of the designer's brain from paper, and reproduce it in iron or steel, either of which is a more stubborn and refractory material to manipulate than wood. It is seldom that the blacksmith can cut or carve his work to shape, but draws, upsets, bends and shapes it until it assumes the desired form.

In making forgings from the solid, which is almost invariably the rule when it is possible to do so, it takes more thought and skill to determine the right amount of material to leave between shoulders or collars, to draw to a certain length and diameter, than it does to make a piece of the same shape of wood by cutting. The patternmaker can handle his wood with his bare hands from the time he commences until it is completed. But the blacksmith has to handle his with a pair of tongs, as it necessarily has to be heated to render it pliable. If it is of large dimensions it has to be lifted and turned by means of a crane, which makes it necessary for the smith to devote a certain amount of attention, energy and skill to handling his work at the same time that he uses his tools to shape it.

The prevailing sentiment seems to be to discourage blacksmithing from whatever point of view it is looked at. So little attraction is connected with the average blacksmith shop that the average American boy avoids it as he would the pest house. The result is that this country has to depend to a great extent upon blacksmiths from other countries. The general impression seems to be that brawn and muscle are more essential to the blacksmith than brains.

Any manufacturer of machines will gladly supply tool equipment to go with his machines for some particular class of work, or all the information necessary for making them, together with data that will insure that the machine will give satisfaction, and turn out work to its full capacity. But literature for the blacksmith is in such microscopic proportion, to the importance of the work, and so unreliable that it might as well be said not to exist.

When a trip or steam hammer is installed in a blacksmith shop it is equipped with nothing more than a pair of plain-faced dies, which are practically of little use in the making of forgings without an equipment of other tools and appliances to be used in connection with them. Upon these the manufacturers of steam or trip hammers give no information. Nor does the draftsman usually get a job designing them, as he does with tools for other mechanics. But it is up to the blacksmith, not only to design, but construct such tools and appliances as go to make a power or steam hammer a paying investment. There is no other branch of metal working so rich in difficult problems, or that has a wider variety of work to be done than blacksmithing. There is practically no other mechanic who designs and makes the tools he uses.

I appreciate the fact that I have poked a stick in a hornet's nest, but I know that the blacksmith's condition cannot be made much worse than it is. There is a chance that there may be broad-minded readers like Mr. Harris who will read this and size up the situation from an unprejudiced point of view.

Plainfield, N. J. JAMES CRAN.

Blanking and Drawing Shells

In the article on "Blanking and Drawing Shells at One Stroke of a Single-acting Power Press," on page 536, the sketch shown appears to me as rather misleading, since in its operation the blanking punch forces the planishing surface down and then the drawing punch *F* should enter the drawing die, which in this case is in the blanking punch. According to sketch this is not possible, as the drawing die with its spring knockout is shown smaller than the punch, when it really should be a trifle larger, the difference in size depending upon the thickness of metal used for the shell.

Waterbury, Conn. MODERN.

[Modern is correct, but these sketches are often not to scale and it is obvious that a punch must be smaller than the die it enters.—ED.]

Casting a Brass Nut on a Steel Screw

Referring to the article on page 684, showing how to cast a bronze bushing on a single-, double-, or triple-threaded screw, I once had a large steel screw, 6 inches in diameter, 6-inch lead, triple thread to cut. It was to have a bronze nut cast on it, the nut to be about 14 inches long. We cut the screw and sent it to the brass foundry, and in course of time it came back with the nut cast off, but we could not budge it.

Finally, one old fellow who had grown gray in the business, suggested that we heat the nut and screw together in the forge furnace, and see whether it would come off when cold. We tried the suggestion and the result was that we were able to twist the nut off the screw with very little effort.

Since that time I have used this method entirely, and always with success. Whether the screw shrinks in cooling or the bronze nut expands, I never took the trouble to find out, but I do know that the scheme will work every time. I tried it the other day on a 2-inch lead triple-thread steel screw 1 inch in diameter, with the usual good success. I had never tried it on a screw as small as 1 inch, and I had some doubt about it coming off as easily as one of larger diameter.

CHAS. F. LOGAN.

Taunton, Mass.

Why the Two Heat Shrinks

I see the item of T. Toot entitled, "Two Heat Shrinks," on page 753, and I have had some similar experiences, more than once in my own practice. The reason for Mr. Toot's collar being too large the first time and then being a fit the second time he heated it, is that possibly the first time he placed a thin collar (and possibly his collar was heated too hot the first time) on the cold shaft, which having a greater amount of metal in it than the collar it caused the inner wall of the collar to cool enough to cause the surface to set in the expanded condition. And after being on the shaft once, he probably did not heat it so hot the second time and it cooled more uniform and in so doing the tool-steel collar resumed its original position and thus was tight on the shaft.

Paris, Ill. J. F. ROBERTSON.

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CIRCULATION STATEMENT

During 1907 *we printed and circulated* 1,151,500 *copies of the* AMERICAN MACHINIST.

Our circulation for November, 1908, *was (weekly, monthly and European)* 90,000.

December 3	33,000
December 10	18,750
December 17	18,750
December 24	18,750
December 31	19,000

This paper reaches 33,000 *separate readers each month and* 19,000 *each week.*

None sent free regularly, no returns from news companies, no back numbers. Figures are live, net circulation.

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Industrial Education by Manufacturers' Initiative

Much has been said and a little has been done toward the introduction of improved methods in industrial education in this country, and from it all it is now possible to size up the movement and to indicate what seems to us the most promising line of advance for the immediate future.

We believe there is altogether too much disposition to rely upon the public character of the movement for industrial education, and to wait for the establishment of industrial schools as part of the public-school system. Whatever one may think of the desirability of schools of this character, and without attempting to discuss them at all, we believe that if manufacturers depend upon them as a solution of the problem of industrial education they will go without such education for many years to come. Instead of depending upon the general public, we believe that manufacturers must, for the immediate future, rely upon themselves through the establishment of organized apprentice systems and apprentice schools combined with them, after the plans now in operation at Lynn, Mass., Bridgeport, Conn., and Cincinnati, Ohio.

We do not believe that the public is yet educated to the establishment of industrial schools as part of the public-school system, nor that it will be so educated in the immediate future, and even were it so educated we do not consider the present public-school authorities competent to establish effective industrial schools. Whatever the ultimate end may be, we believe that manufacturers must lead and show the way, as was done, for example, in Milwaukee, where the Milwaukee trade school has become a part of the public-school system as an outgrowth of its success as a private enterprise.

We believe the most fruitful outcome of this entire discussion and movement, considered as an example to be followed, to be the school established by Mr. Alexander at the General Electric Works, of Lynn, Mass., and that that school points the way to the line of progress from which the most is to be expected in the way of immediate results.

So far as trade teaching, properly so-called, is concerned, Mr. Alexander has done a very simple, although a highly important thing, which, as we understand it, is not much more than the taking of the apprentices out of the authority of the foremen and placing them in a room by themselves under the immediate charge of a teacher.

When we consider the surroundings and opportunities to a boy just entering a shop under the conditions that commonly prevail, it is not surprising that the employer does not find him profitable nor that the boy soon gets discouraged and quits. Few foremen have either time or talent for teaching, and, with even the best spirit in the world, the fact that he is charged with getting out the product and doing it as cheaply as possible, makes it necessary for him to give the boy some simple task which he can soon learn and then keep him at it as long as possible.

A little consideration of these conditions will make it plain why, under the systematic instruction of a competent teacher, the boys make such rapid progress in Mr. Alexander's school and thus become not only profitable employees, but able to earn the higher wages that they are paid and contented apprentices at the same time.

So far as the class-room work is concerned, it is possible to vary Mr. Alexander's plan by the organization of a coöperative school, as has been done at Bridgeport, or by the adoption of the half-time plan, as at Fitchburg, although under the latter plan special teachers who can give their work some connection with the shop work must be found if full satisfaction is to be experienced. Without such teachers the boys must necessarily be given substantially the same instruction as that of the full-time pupils, and this we regard as the most serious menace to the half-time plan. It is easy too to look with complacent satisfaction on the half-time plan as the whole thing and ignore the fundamental features of Mr. Alexander's plan, the giving of systematic shop instruction through a teacher who is in immediate charge of the boys. After all, what is wanted is skilled, intelligent workmen, and they can be obtained only through trade teaching. To ignore this part of Mr. Alexander's plan is to ignore the largest half of it.

It is, we believe, obvious to those who have given the subject attention, that the conditions of employment surrounding the so-called apprentice of today, as described above, supply the immediate and sufficient reasons for the reluctance of boys to enter the shops. The boys have discovered, in the slang of the day, that there is "nothing in it" for them under these conditions, and we must own that we consider the conclusion of the boys to be not far wrong. Right or wrong, it is this feeling on the part of boys and their parents which is, we believe, at the root of the difficulty of getting boys to serve apprenticeships. If boys are to be attracted to the shops apprenticeship must in some way be made more attractive to them. Experience with these organized apprentice schools, so far as it has gone, appears to indicate that they do attract and hold the boys, and as they also succeed in making profitable employees of them, they indicate plainly enough that in this is an immediately available avenue of progress, and that is what all are looking for, rather than a general discussion of methods which should ultimately prevail.

Meeting for Discussing the Prevention of Accidents and Compensating the Injured

The American Anti-Accident Association, located at Sharpsville, Penn., desires to hold a public meeting in New York City about the close of January, for the purpose of having a wide and practical consideration of the following two questions:

First. What universal actions are best to aid the prevention of accidents with their accompanying losses of life and property?

Second. What methods will be most humane and reliable to compensate the injured and afflicted through accidents and also prove the most just for all concerned?

In view of the fact that at least 14 of the 31 legislatures which will be in session this coming winter are to consider the question of employers' liability, it is felt there should be no delay in giving the broadest publicity to all facts, experiences and views that it is feasible to obtain on this second question.

In regard to the first question the factor whether care and faithfulness in work or recreation is not more important than safety devices in best helping to prevent accidents is also a feature that demands the fullest expression of views, experiences and facts. It is timely that this whole subject should be directed to correct channels in order that we may best prevent accidents and a meeting as above suggested should do great good for the cause.

A cordial invitation is tendered to Government and municipal officials, professional men and women, proprietors, office and shop managers, union labor leaders, merchants, artisans, laborers, insurance officers, factory inspectors and all others who may feel an interest in the work, to attend this meeting of which the time and place are to be arranged for later. Any desiring to be present or wishing further information may write Thos. D. West, president of the association, Sharpsville, Penn.

A New Correspondence School

A new corporation bearing the name of the Modern Systems Correspondence School Company has been organized with our contributor, Oscar E. Perrigo as president and Norman W. Henley as secretary and treasurer.

The school which this company will conduct will give instruction in modern cost systems; factory and commercial office systems; shop methods and systems; shop construction, equipment, organization and management; foundry systems; mechanical drawing and engineering systems, together with other allied subjects. The school will have an office under the management of Mr. Perrigo at 6 Beacon street, Boston, and a New York office at 132 Nassau street, under the management of Mr. Henley.

New Publications

HARPER'S HOW TO UNDERSTAND ELECTRICAL WORK. By William H. Onken, Jr., and Joseph B. Baker. 359 5½x7¾-inch pages; numerous illustrations; not indexed. Harper & Bros. Publishers, New York City. Price, in cloth, $1.75.

This is a general rather than a technical book and is written for the bright boy and girl, who ask why and how electricity moves a trolley car or lights an incandescent lamp in the home, or rotates an electric fan, or heats an electric furnace, and the like. It is essentially a description of electrical appliances, but is written by practical men and presents a popular book that is thorough and complete in its treatment of its subject. The language is simple, non-technical, and will be comprehended readily by young readers. Its fifteen chapters treat of how electricity is made and used; electric light, heat, power and traction; electricity on the farm, in the hospital, on board ship and in mining; and electricity as a protector, destroyer and the means of transmitting intelligence.

APPLIED MECHANICS (STATICS). By Alexander Norwell. 235 4¾x7¼-inch pages; 218 illustrations; indexed. Longmans, Green & Co., New York City. Price, 60 cents.

This work is an elementary textbook of applied mechanics dealing with statics. It covers the usual field of such a textbook for engineering students. The particular feature of the work is a system of units that has been adopted in working out examples. While this is not new, it is not generally followed in the teaching of mechanics, although it is possessed of some easily recognized advantages. By such a consistent use of units the memory of the student is relieved from the strain of endeavoring to remember what units should be inserted after an arithmetical quantity obtained as the answer for a problem. Again, the units when properly handled, act as a check on the arithmetical quantities, and their consistent use tends to make the entire subject more logical, and to give the student greater facility in the handling of equations and formulas without the fear of obtaining an absurd answer.

INTERNAL COMBUSTION ENGINES. By R. C. Carpenter and H. Diederichs. 610 6x9½-inch pages with numerous illustrations. D. Van Nostrand Company, New York. Price $5.

It is difficult to express a general opinion regarding this book because of the very uneven quality of it. In places it is admirable; in others disappointing. However, one cannot expect perfection even in textbook authors. The work is largely compilation, and this has been done with the high degree of skill which would naturally be expected of these authors. It is regrettable, however, that more original work, for which Professors Carpenter and Diederichs have excellent opportunities and conspicuous ability, was not put in the book.

The descriptions of commercial types of engines and producers are among the best portions of the book. The presentation of fundamental principles is good, although it adds nothing to the fund of knowledge previously established. The discussions of combustion, gas-engine fuel mixtures and regulation (governing) are excellent.

The final chapter, on cost of installation and operation, is the most valuable one in the book; it will doubtless become obsolete in a relatively short time, however, because of the rapid progress that is being made in the direction of standardization and improvement of design and manufacturing methods.

Personals

Edwin E. Bartlett, of Boston, has just returned from a two months' business trip to Europe.

L. H. Mesker, who has been looking after the interests of the Motch & Merrywether Machinery Company, is now connected with the Cleveland office of Manning, Maxwell & Moore.

Arthur T. Letherby, for the past 10 years superintendent of the Hamilton Machine Tool Company, has resigned his position to take effect Jan. 1, 1909. After that date he will become vice-president and superintendent of the Kern Machine Tool Company, of Cincinnati, Ohio, having purchased an interest in this company.

Charles T. Main, mill engineer and architect, has been appointed by the council of the American Society of Mechanical Engineers as a member of the National Conservation Commission, with special reference to water powers. Mr. Main is particularly well equipped for this work through wide experience in examinations and reports upon various water powers in this country and in Mexico and British Columbia.

Probably the smallest automatic screw machines made are those used in making the balance or compensating screws for the balance wheel of a watch. These screws have a head about 0.05 inch in diameter and about the same length while the threaded portion is 0.0225 inch in diameter and has 220 threads to the inch. These machines make these from the brass wire, making 600 complete screws an hour including the slotting of the head.

New Tools and Machine Shop Appliances

Showing New Ideas in Machine Shop Equipment That Make It Possible To Do Better Work at a Reduced Cost

THE LATEST INFORMATION

The New Whitcomb-Blaisdell Lathe

This is an all-geared lathe, designed to meet the demand for a constant-speed drive and geared feeds, that is built without sliding gears and only uses the sliding key in the feed mechanism. As can be seen from Figs. 1 and 2, which show an 18-inch lathe, the controlling handles are conveniently located and within easy reach of the operator. In the end view the gear guards have been removed to show the feed train. The different feeds or threads are easily obtained and there is an indicator for catching threads on the end of the carriage as well as a taper attachment on the back.

The Geared Head

The head drive comes through the pulley *X*, Fig. 3, keyed to the shaft which drives the gears 1, 3, 5 and 7. These mesh into gears 2, 4, 6 and 8, shown in the head, each of which can be clutched to the hollow friction shaft *Y* by either of the four clutches *E*, *F*, *G* or *H*. These are operated by the handle near the front of the lathe head which gears into pinion shaft *A*. This moves rod *B*, which carries cam shaft *C* with its four cam blocks *D*, *D*, *D*, *D* to engage any of the four clutches desired.

As shown, gear 2 is clutched to shaft *Y*, which drives pinion 12 in mesh with face gear 11 for one of the slow speeds.

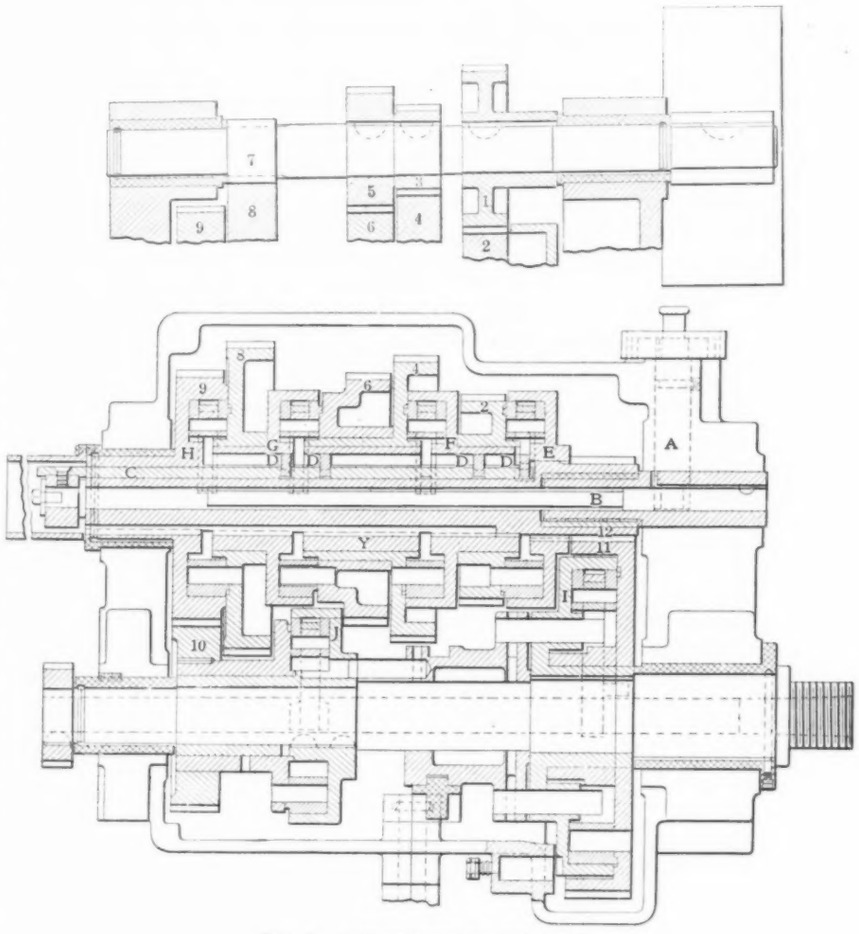
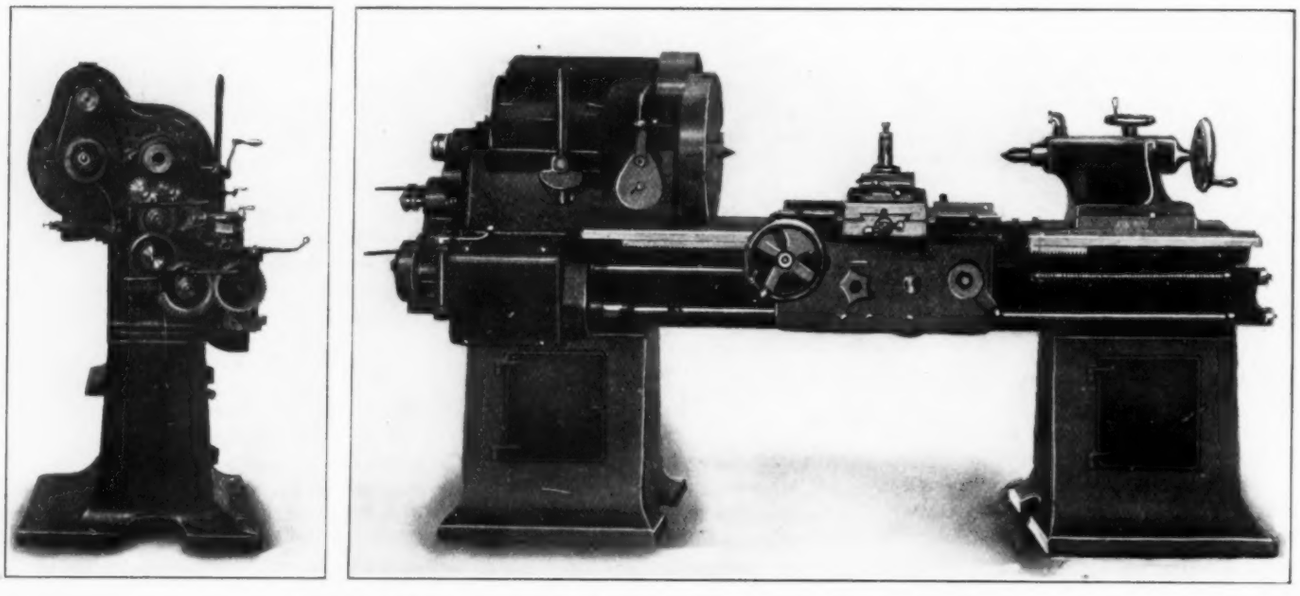


FIG. 3. THE GEARING OF THE HEAD



FIGS. 1 AND 2. TWO VIEWS OF THE WHITCOMB-BLAISDELL GEARED LATHE

In the same way clutches *F*, *G* or *H* drive the friction shaft *Y* with gears 4, 6 or 8 and the power is transmitted to the face gear by the pinion as before, providing, of course, that the central handle in front of the head is moved to right to engage the clutch, as shown.

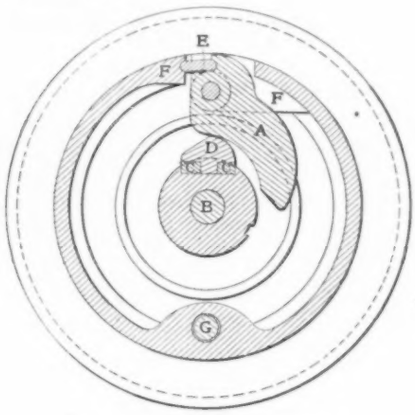


FIG. 4. THE CUSHION CLUTCH

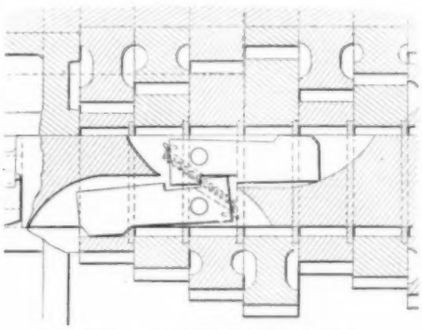


FIG. 5. THE FEED-GEAR KEYS

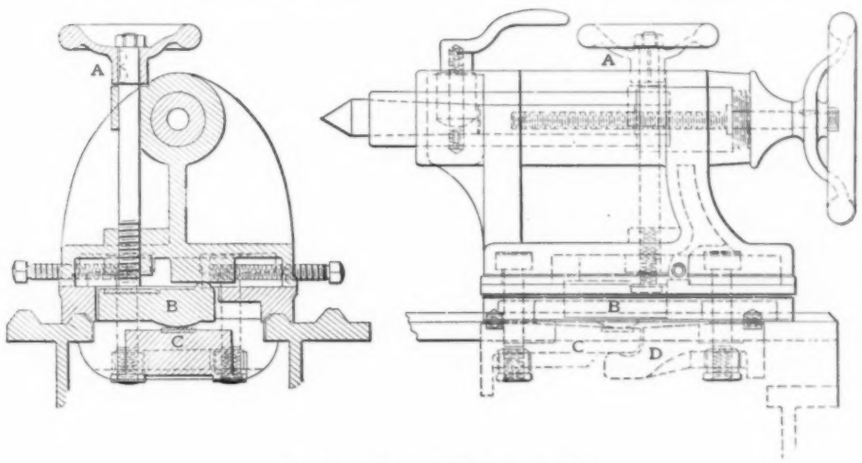


FIG. 6. THE TAILSTOCK DETAILS

Clutch *H* locks gears 8 and 9 together and drives gear 10 so that when the handle is moved to the left, clutch *I* is disengaged and *J* thrown in, making gear 10 the spindle-driving gear instead of 11 as before and securing another set of four speed changes in this way. This whole head runs in oil so that every part is thoroughly lubricated at all times. With a pulley speed of 225 revolutions per minute, the spindle speeds vary from 8.8 to 237 revolutions per minute.

The Cushion Clutch

The vital feature of any friction head is the clutch and in this is combined an easy gripping device with a large bearing surface, together with the feature of increasing the grip the more work it is called on to do. Rod *B*, controlled by the front handle, as has been shown in Fig. 3, and, as shown in Fig. 4, the cam *D* has been brought under the tongue or lever *A*. The curve on the under side gives an easy movement of the lever, which is pivoted on one end of friction band *F*, this being anchored at *G*.

The cam *D*, lever *A* and connection *E* are of hardened steel, while the friction ring is of cast iron, all running in oil. Any tendency to slip forces cam *D* further under the lever, and the combination has proved well suited to carry any load that could be put on it in their own shop.

The all-geared feed is of the double-cone type with the hardened washers and keys with beveled ends. These are arranged very neatly, as shown in Fig. 5. Double keys are used, one for each cone, so spaced that only one key can engage at once. The key that is held out by the washer increases the tension on the spring and holds the other key into the keyway so as to prevent slipping.

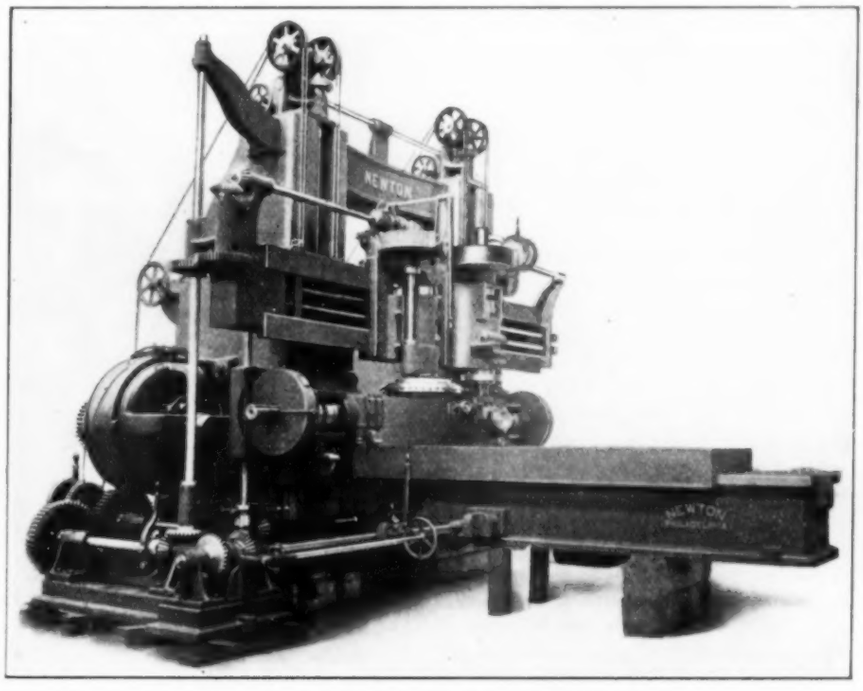
The Tailstock

A departure has been made in the method of clamping the tailstock to the bed. The handle *A*, Fig. 6, is keyed to a vertical shaft, which screws through the lower portion of the tailstock and bears against a hardened plate in rocker *B*. The rounded end of this bears against the under side of the base, while the center bears on the hardened plate in block *C*. This in turn bears on the end of *D*, and as they pull against the four bolts from the fulcrums shown at each end, it makes a very solid clamping device, and one that is quick and easy to operate.

This is built by the Whitcomb-Blaisdell Machine Tool Company, Worcester, Mass.

A Heavy Four Spindle Milling Machine

The table of the machine shown is 42 inches wide and 18 feet long over all, and will mill 16 feet in length. The maximum distance between the ends of the horizontal spindles is 60 inches and the minimum distance is 36 inches. Maximum distance between ends of the vertical spindles and the top of the work table is 66 inches, and the minimum distance between centers of the vertical spindles is 32 inches. The two side heads and the right-hand head on the rail are of the same general design. The spindles are 5⅜ inches in diameter, have a brass-



A HEAVY FOUR-SPINDLE MILLING MACHINE

bushed bearing 17 inches in length and have a double-taper bearing in the mouth of the adjusting sleeve 8¾ inches long. The ends of the spindles have an external thread onto which the face cutters can be fitted or a No. 5 taper to which the end mills can be fitted with a hole entirely through the spindle into which a retaining bolt is fitted; in addition there is a broad face slot in the end of the spindle to correspond to the broad face cutters used on many of these heavy cutters.

The drive is through steep lead bronze worm wheels approximately 20½ inches in diameter and a hardened-steel worm having roller-thrust bearing; both of these are encased and continually run in oil. The rack sleeve is of sufficient length to permit of an independent adjustment to the spindle on the saddle of 12 inches by means of the adjusting worm and worm wheels shown, operated by hand wheels. The left-hand saddle carries an auxiliary slide into which is mounted the spindle carrying a solid cast-steel rotary planing head 20 inches in diameter over the cutting tools. This cutter head is driven through steep lead-bronze worm wheel and hardened-steel worm of similar design to the other heads by a pinion-shaft meshing with the internal-cutter head gear.

The cross-rail, as are also the side heads, is counterweighted, and is so arranged with the plain surface on the bottom that the side heads can be attached to it by means of swinging bolts and elevated with the rail by power when so attached.

The elevating screws have roller thrusts top and bottom bearings on the rail, permitting of maintaining a tension on the screws when pulling the cutters into the work. The drive is by means of a 50-horsepower General Electric motor running at 560 to 1120 revolutions per minute.

There are available table feeds at the high speed of the motor from 0.789 to 8.15 inches per minute, and at the slow speed of the motor feeds of from 0.394 to 4.08 inches per minute, and quick return in both directions at the rate of 21.94 feet per minute. The maximum feed to the rail vertically and the saddles on the rail is 4½ inches per minute with the motor running at 1120 revolutions. This machine was built by the Newton Machine Tool Works, Inc., Philadelphia, Penn.

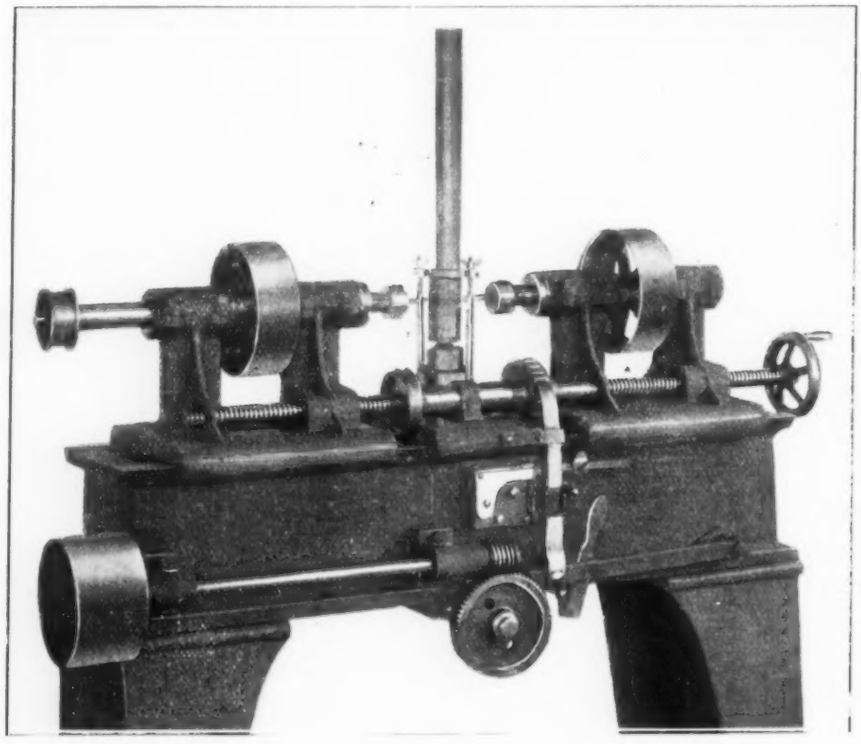


FIG. 1. DOUBLE-HEAD DRILL-SPINDLE SLIXING MACHINE

Splining and Polishing Machine

In the manufacture of drill presses, the splining of the spindles is quite an item and the machine shown in Fig. 1 has been designed for that purpose. The spindle is centered on a standard taper plug held in a plunger which is fed up and down by a crank driven by the worm wheel at the center of the bed, this taking its motion from the small pulley at the end of the left-hand head. At the end of each stroke of the plunger carrying the spindle, the ratchet mechanism shown, feeds the fish-tail cutters into the work by the right- and left-hand screws controlling the heads. When the cutters have approached each other so as to leave a thin web the heads strike a trip which throws out the feed. Then the two screws are disconnected and one head fed forward alone. This is done automatically so that no attention is needed except to put in and take out the work.

Fig. 2 shows a polishing machine which needs little explanation. This has been designed to finish cone and drive pulleys after they have been turned. The illustration shows a cone pulley mounted in the lathe ready for polishing. It is driven by a stud from the face plate engaging with the spokes of the pulley and to save time the pulleys are run on cone centers instead of an arbor as shown. The polishing wheel is moved over the work by the handle over the tailstock of the lathe.

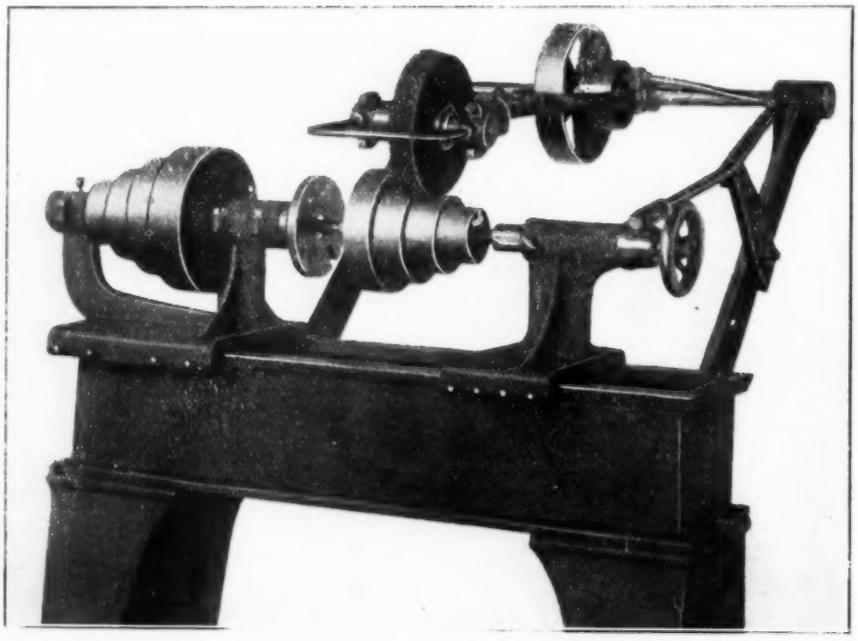
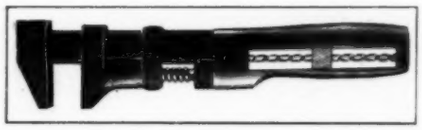


FIG. 2. MACHINE FOR POLISHING CONES

These machines are made by the Hoefer Manufacturing Company, Freeport, Ill.

A Quick Action Wrench

This wrench has two screws, one for rapid adjustment to or near the required size, as well as the regular finer adjustment. The rapid-adjusting screw is in the handle, out of the way and yet readily

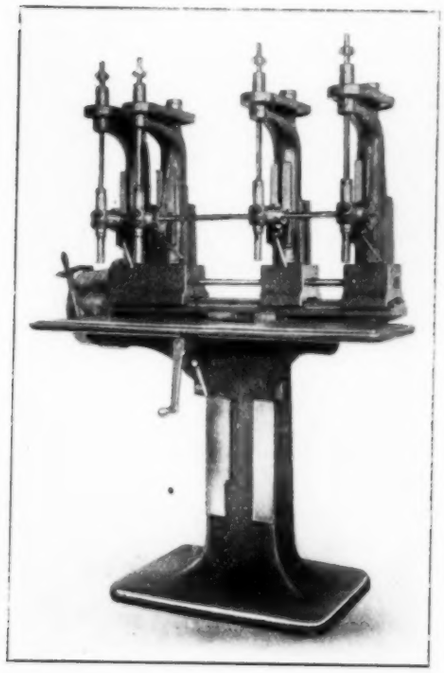


A QUICK-ACTION WRENCH

accessible. This is known as the McArthur wrench, and is made in Canada by W. E. Hamilton & Co., 6 St. Sacramento street, Montreal.

A Four Spindle Simultaneous Feed Drill Press

The accompanying photograph shows a new adaptation of the Taylor & Fenn Company's regular manufacturers' drill press. The particular feature of this machine is that all of the spindles are simultaneously fed to the work. This is accomplished by connecting the feed pinions by a splined shaft. Any number of feed levers may be applied, the machine shown in the photograph having two. This arrangement in no way interferes with the adjustable features of the machines.



A FOUR-SPINDLE SIMULTANEOUS-FEED DRILL PRESS

This type of machine is particularly adapted for drilling a large number of duplicate parts having the same distance between the holes to be drilled.

By releasing the keys in the hubs of the feed pinions the connecting shaft may be used independently as in our regular type of machine. This type of machine is built with any number of spindles up to six by the Taylor & Fenn Company, of Hartford, Connecticut.

Inserted Blade Tap and Holder

The illustration shows an inserted blade tap in a holder or guide which makes it easy to use it in a lathe, boring mill or drill press. The inserted blades have a small gib on the lower edge which fits into a slot in the body and holds them in place. They are adjustable for size and can be easily renewed.

In lathe work the holder fits the outside of the tailstock spindle and guides the tap while a wrench on the square of the shank keeps it from turning, as seen in Fig. 2. Similar applications to other machines can easily be made.

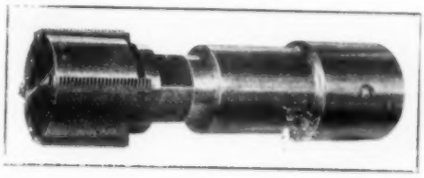


FIG. 1. TAP AND HOLDER

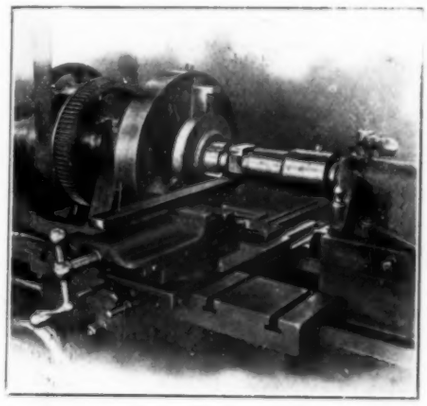


FIG. 2. USED IN A LATHE

These taps are made both for pipe and straight work from 1 up to 12 inches in diameter by W. H. Nicholson & Co., Wilkes-Barre, Penn.

An Artificial Grindstone

A new method of grinding glass has been discovered by the Onward Manufacturing Company, which has factories at Menasha, Wis., and Berlin, Ont. This discovery is a grindstone made from one-half best portland cement and one-half silica sand, the ingredients being thoroughly mixed and tamped even. When properly made the stone has no hard and soft spots, and it will grind glass without scratching. The cost is about 10 per cent. of the common grindstone. The new stone has been used successfully for one year and found to be far superior to natural stone.

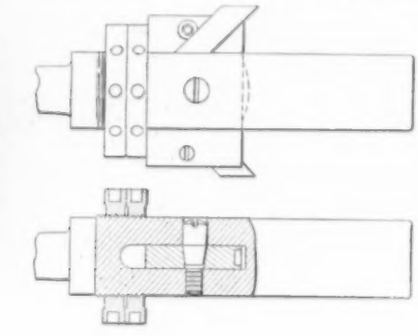
The Crescent Wrench

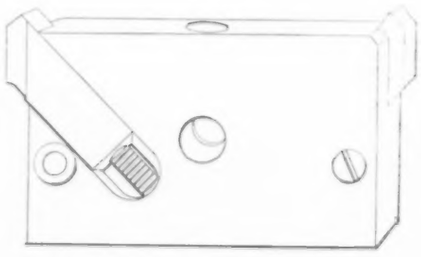
This is a drop-forged steel wrench of very rigid construction, which can be used in many places where the solid wrench is generally called for. The eight-inch size shown opens up from zero to 15/16 of an inch. The nurled screw works in the back of the movable jaw and gives the desired adjustment. It is made by the Crescent Tool Company, Jamestown, New York.

CRESCENT DROP-FORGED WRENCH

Large Reamer with Adjustable Cutters

The illustrations show the cutter heads and method of holding them in the bar, used by the Kelley Tool Company, Cleveland, Ohio, in their cylinder reamer. The cutter head is located by a tapered screw and backed up by the two lock nuts so as to present a solid cutter head when roughing, while by slightly slacking off on these a floating reamer is obtained for finishing the hole.





BORING BAR AND CUTTER HEAD

The blades are of high-speed steel, 5/8x1 inch, adjusted by the screw at the back and clamped by the draw screws at

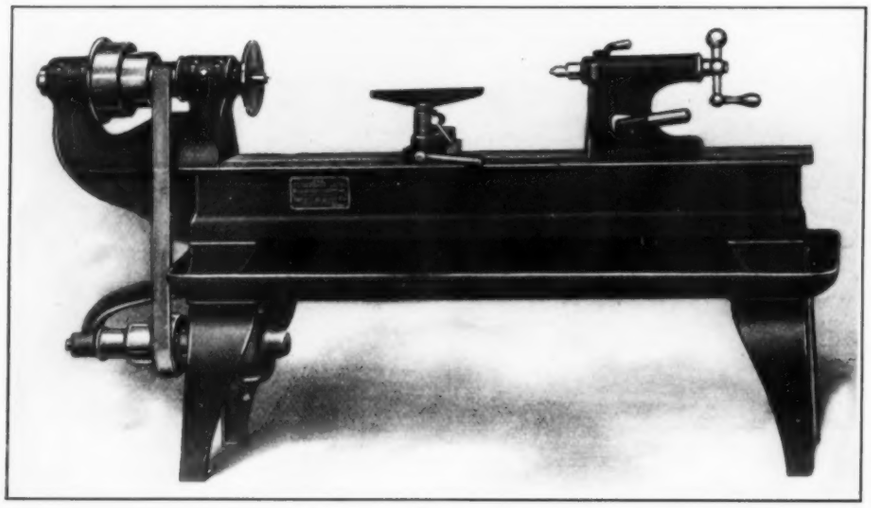
the side. The reamer head is of hardened steel, the cutters fitting very closely and the whole tool being very rigid when the head is locked into the bar.

Improved Reamer

An improvement has been made by R. M. Clough, Tolland, Conn., which enables him to reduce the length of the body from one-third to one-half, according to size, which makes quite a saving in weight. With these, he uses a sharper incline beneath the blades and secures a greater adjustment. These reamers are adjusted by a threaded ring or nut and are made in sizes from ¾ to 6 inches in diameter.

Motor-driven Speed Lathe

This motor-driven speed lathe was designed for manual training schools, but it is equally adapted for light manufacturing purposes. The spindle runs in ring-oiling bearings. The motor is of the constant-speed type, is placed under the pan and protected by the leg. The motor spindle is extended and provided with an outer bearing to relieve the side strain. With this form of drive the speed variations are the same as when a countershaft is used. It is built by the J. G. Blount Company, Everett, Mass.



MOTOR-DRIVEN SPEED LATHE

A Large Edge Grinder

Although this machine was designed especially for finishing locomotive guide bars by grinding, it is equally well adapted for edge grinding of any kind, as can be seen from some of the illustrations of the machine at work. Some of these will be new to many mechanics and they serve to show the progress being made by the makers of grinding machinery in handling many classes of work which were formerly done on the lathe or planer.

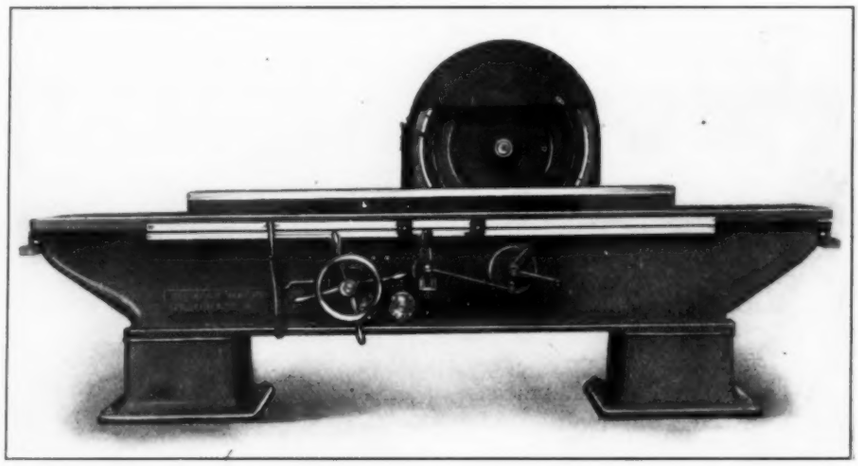


FIG. 1. EIGHTY-FOUR INCH EDGE GRINDER

Among the advantages of a machine of this kind are the comparative independence of the hardness of material, as a proper grinding wheel can take care of much work that would be exceedingly difficult to machine with cutting tools in the regular way. There is not the same necessity for fastening the work rigidly to the table, although this varies with the amount of stock to be removed in a given time.

A 30-inch ring of abrasive material is held in a steel-bound adjustable chuck, the bearings are of ample proportions, are

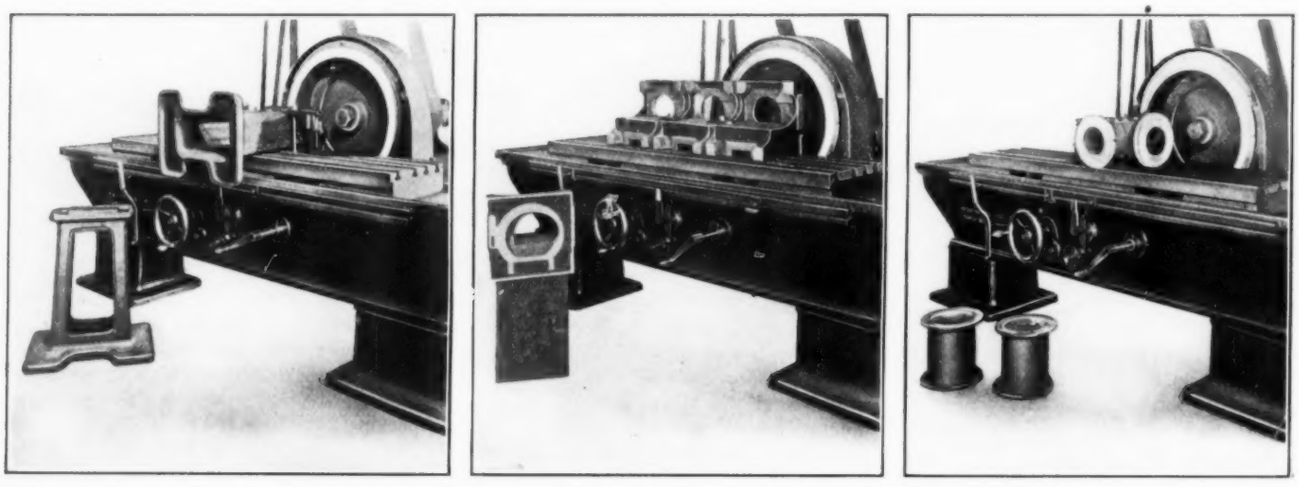


FIG. 2. EXAMPLES OF FACING WORK DONE ON EDGE GRINDER

well protected from dust and ring-oiling babbitt boxes are used, while the end thrust is taken by a special ball bearing. The table feed is much the same as on a planer and has automatic reversing mechanism which can be adjusted to any length of stroke. The work can also be fed by hand when desired. The cross feed can be either by hand or power and fine

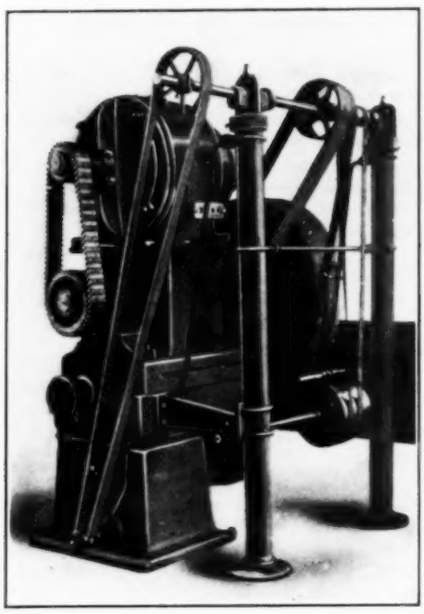


FIG. 3. GRINDER EQUIPPED FOR MOTOR DRIVE

adjustments are provided. An automatic pump is supplied for wet grinding.

These machines are built in two lengths, 84 and 114 inches, respectively, and for either belt or motor drive, but longer machines can be supplied if desired. The illustration shows a machine having 84-inch table travel and requiring a total floor space of 18 feet 4 inches by 7 feet. The table has a travel of 20 lineal feet per minute. This is made by the Diamond Machine Company, Providence, R. I.

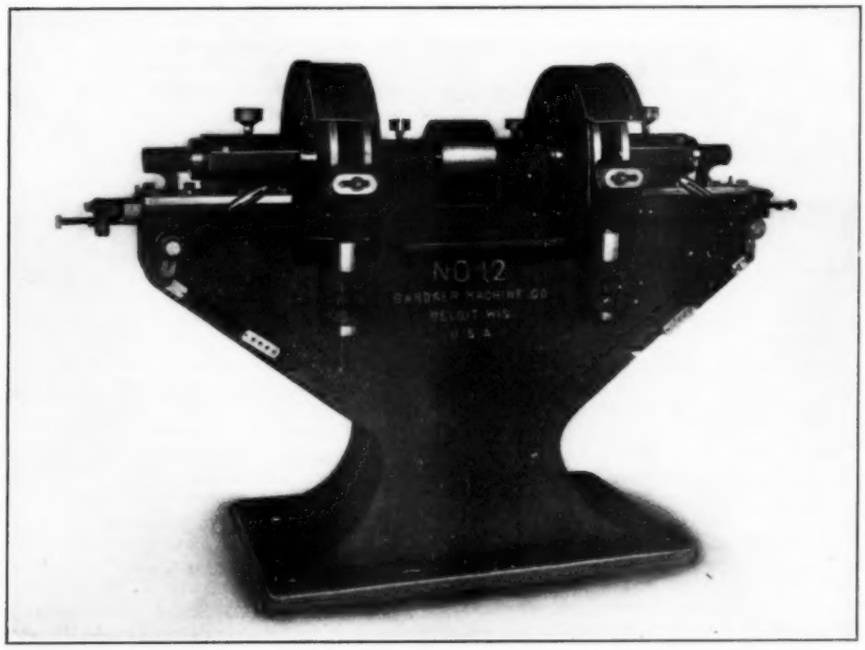
Duplex Disk Grinder with One Belt

The principal feature of this machine is the one-belt drive. The outer disk wheels are mounted on hollow spindles supported in the sliding heads. Driving shafts coupled to the main spindle drive the hollow spindles carrying the outer disk wheels. The driving shafts are splined to engage keys fastened in the hollow spindles, and are provided with dust-proof collars to exclude dust from the hollow spindles.

To remove the disk wheels from the machine it is only necessary to uncouple the driving shaft of the sliding head from the main spindle of the machine. The ends of the driving shafts are made with a right- and left-hand thread and taper seat. The sliding heads may be removed and special work table or fixtures used in connection with a single wheel.

The sliding heads are operated by hand levers which are directly connected to steel-cut pinions operating in steel-cut racks fastened to the under side of the sliding heads. The sliding heads are equipped with micrometer stop screws and back stop, this being important in double-disk grinding, especially where thin work of from ⅛ to 1/32 inch is being ground. Disk wheels of either 15 or 18 inches in diameter may be used. The maximum distance between wheels is 4½ inches, but may be increased to suit special cases.

This is built by the Gardner Machine Company, Beloit, Wis.



DUPLEX GRINDER WITH ONE BELT

A New Departure in Pyrometer Design

By M. E. Leeds

An interesting self-checking pyrometer, radically different from previous types, has recently been developed and placed

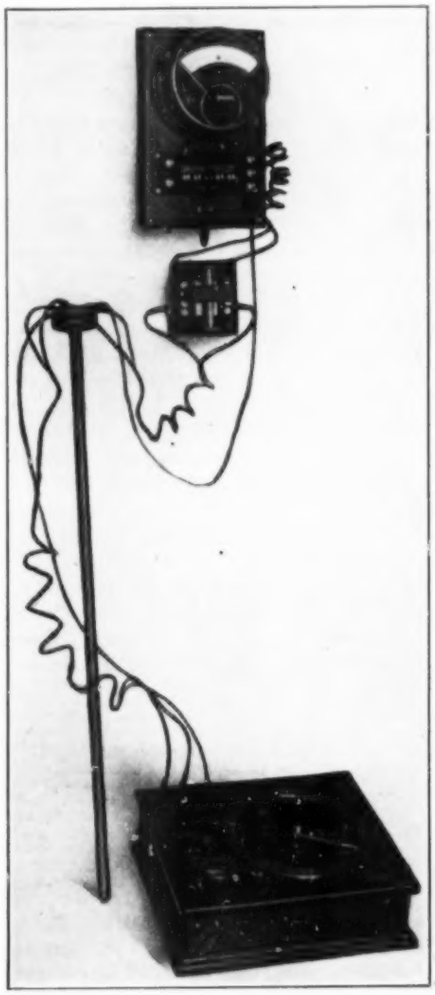


FIG. 1. WALL AND TABLE INDICATOR ATTACHED TO FIRE END OF PYROMETER

on the market by the Leeds & Northrup Company, of Philadelphia. It is especially intended for use where it is desired to hold the temperature of an oven, vat, etc., at a given value, and for this class of work, combines the accuracy and constancy of a Wheatstone bridge measurement with the ease and convenience of a deflection measurement.

The pyrometer consists of two parts, the bulb, or fire end, and the indicator, as shown in Fig. 1. The bulb is a coil of platinum wire, inclosed in a suitable porcelain or quartz tube, and protected by a seamless nickel tube, a sectional view of which is shown in Fig. 2. The indicator consists of a Wheatstone bridge, mounted on the base of a regular switchboard type ammeter. It operates on any direct-cur-

rent system, and is practically independent of voltage fluctuations in the source. Any number of bulbs located at any distance may be read on one indicator through a suitable switchboard.

Owing to the fact that the energy used in the electrical system is supplied from an outside source, the amount may be made as large as is used by a regular switchboard ammeter. A regular stock ammeter without shunt is used, and hence this instrument is as heavily constructed, as robust, as reliable, and as constant, as a switchboard ammeter.

The constancy of the platinum resistance bulbs is shown by tests made by the National Bureau of Standards. Resistance bulbs in practically constant use for over two years at 1800 degrees Fahrenheit show a change of less than 6 degrees Fahrenheit.

The regular indicator is supplied with a 5-inch, 220-degree Fahrenheit scale, and has extension plugs to extend the range to 1000 degrees, thereby giving the instrument the equivalent of a scale 25 inches long. It is available for any range below 1800 degrees Fahrenheit. Due to an overlapping scale, this instrument may be checked up at four points throughout its range without disturbing any part of the apparatus.

As is above stated, the instrument employs the Wheatstone Bridge method. At one point for every 200 degrees of its range, the Wheatstone Bridge is balanced and the readings of the instrument are independent of calibration of the ammeter.

This balance point is placed in the center of the scale. If the ammeter, due to any cause is 3 per cent. off calibration, the error in the temperature is 3 per cent. of 100 degrees, or 3 degrees. If the temperature, being measured, is 1800 degrees, the error due to the reading instrument would be 3 degrees. To look at the principle of the instrument somewhat differently, the great bulk of the measurement is made on the Wheatstone Bridge, the ammeter taking the residual, consequently, an error in ammeter only affects the measurement of the residual, which equals only 100 degrees. Constructed, as it is, of non-movable, perfectly protected standard resistance coils, nothing short of absolute and wilful abuse can injure the Wheatstone Bridge. From the fundamental principle of the bridge, it is independent of the voltage of the circuit which supplies the energy.

This balance point may be placed at such values as will best adapt the instrument to the needs of the user, and will then indicate departures from this temperature so clearly that a workman can stand at a considerable distance from the indicator, and clearly note if the temperature is too cold or too hot.

The portable type of indicators made by this company are entirely independent of the calibration of a galvanometer. The measurement is made on a scale 16 to 25 inches long, located on a circle 6 to 8 inches in diameter, the galvanometer merely indicating when the operator has turned the index to the proper position on the scale. With this type of instrument, which has been for some years past, used in many industrial establishments in the hands of men unable to read English, the company are prepared to guarantee an accuracy of 5 degrees at 1700 degrees Fahrenheit.

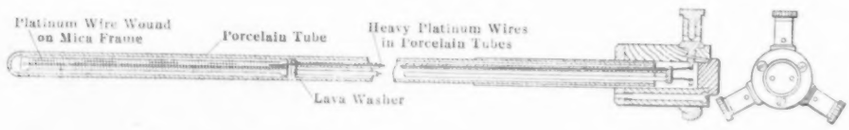


FIG. 2. SECTIONAL VIEW OF FIRE END OF PYROMETER

Business Items

The Laidlaw-Dunn-Gordon Company, New York City, has recently closed a contract with the Stewart-Kerbaugh-Shanley Company for a large air compressor plant to be used in connection with its contract comprising some fourteen miles of the new Catskill mountain aqueduct to supply water for New York City.

Trade Catalogs

Hart Manufacturing Company, Cleveland, Ohio. Phamphlet No. 281 describing Buckeye die-stocks. Illustrated.

The Fosdick Machine Tool Company, Cincinnati, Ohio. Circular illustrating and describing half and full universal radial drills.

Independent Pneumatic Tool Company, Chicago, Ill. Circular L, illustrating and describing Thor pneumatic tools and appliances.

The Hancock Inspirator Company, 85 Liberty street, New York. Catalog of Hancock valves. Illustrated, 40 pages, 6x9 inches, paper.

The S. Obermayer Company, Cincinnati, Ohio. Catalog No. 40 and price list of foundry supplies. Illustrated, 370 pages, 6x9 inches, paper.

Westinghouse Electric and Manufacturing Company, Pittsburg, Penn. Circular No. 1157, describing Type S transformers. Illustrated, 16 pages, 7x10 inches.

Calculagraph Company, 9 Maiden Lane, New York. Pamphlet describing operation of telephone in factory cost accounting. Illustrated, 24 pages, 6x9 inches.

The Bristol Company, Waterbury, Conn. Bulletin No. 100, describing combination indicating and recording unit of Bristol electric pyrometers. Illustrated, 8 pages, 8x10½ inches.

General Electric Company, Schenectady, N. Y. Bulletin No. 4632, describing electric fan motors. Illustrated, 32 pages, 8x10½ inches. Bulletin No. 4633, describing motor generator sets. Illustrated, 24 pages, 8x10½ inches.

Fort Wayne Electric Works, Fort Wayne, Ind. Bulletin No. 1109, describing multiphase alternators revolving field, engine drive. Illustrated, 8 pages, 8x10½ inches. Pamphlet No. 5016, entitled "A Practical Guide for Transformer Testing." Illustrated, 46 pages, 5x8 inches.

Western Electric Company, 463 West street, New York. Bulletin No. 5113, describing three-wire generators, "L" design. Illustrated, 12 pages, 8x10½ inches. Booklets containing instructions for installation and operation of design "L" and design "E" generators and motors.

Business Opportunities

Joseph Roth, Green Bay, Wis., is building a new foundry.

The City Iron Foundry, Lowell, Mass., will build an addition.

A new $30,000 plant will be erected for the Rome (Ga.) Hosiery Mill.

The Strubler Computing Scale Company, Elkhart, Ind., will erect a new plant.

The Johnson Traction Engine Company, Sunnyvale, Cal., has bought site for a plant.

The Lexington (Ky.) Motor Car Company, recently organized, has purchased site for plant.

The Pennsylvania Railroad Company will erect a new boiler shop at the shops in Renovo, Penn.

The Buckeye Stave Company, Fostoria, Ohio, whose plant was recently burned, is preparing to rebuild.

The Acme Box and Lumber Company has been organized and will erect plant. C. R. Swartz, president.

The plant of the Whiteman Paper Mill, Dansville, N. Y., was destroyed by fire, causing a loss of about $60,000.

The Central of Georgia Railroad will spend $1,000,000, it is said, in erecting new buildings at the shops in Macon, Ga.

The Kelley-Taneyhill Company, Waterloo, Iowa, makers of well-drilling machinery, will erect an addition to its plant.

The Duncan Foundry and Machine Company, Alton, Ill., is erecting a new building to be used as an iron-molding shop.

The Royal Weaving Company, Pawtucket, R. I., will erect two new mills at Darlington, to give employment to 800 people.

The Specialty Manufacturing Company, Kankakee, Ill., manufacturing washing machines, will move to Green Bay, Wis., it is said.

The Crosby Company, Buffalo, N. Y., will erect an addition to its plant for the manufacture of stamped sheet-metal goods.

The Cincinnati Planer Company will build an addition to its plant at Oakley. This will be an exact duplicate of the present plant.

The Baton Rouge (La.) Realty Company will establish a plant at Corbin, La., for the manufacture of staves and ax handles.

The Goodell-Pratt Company, Greenfield, Mass., manufacturing machinists' tools, has awarded contract for the erection of its new foundry.

Thos. Wathey, Byesville, Ohio, is interested in a foundry about to be started and would like estimates on building and equipment.

A. Weiskittel & Son, Baltimore, Md., manufacturers of stoves, enameled iron ware, etc., will erect an addition to its plant to cost $15,000.

The Dain Manufacturing Company, of Ottumwa, Iowa, will erect a factory in Welland, Ont., for the manufacture of its farm implements.

The Tennessee Coal, Iron and Railroad Company will erect a new repair shop at Ensley, Ala., to be equipped for repairing all kinds of electrical work.

The Iron City Sanitary Manufacturing Company, Zelienople, Penn., is erecting an addition to be used as a foundry and core room.

The Republic Stove and Manufacturing Company, Cleveland, Ohio, has awarded contract for the construction of a two-story addition.

Bones Bros., Pulaski, Va., will erect machine shop for the repair of vehicles, etc.

The Radford (Va.) Pipe Company will erect an addition to its molding department, doubling the capacity.

The Jametsown (N. Y. Shoe Machinery Company, has been incorporated to manufacture shoe-making and shoe-repairing machinery. A. H. Hitchcock, J. E. Toscan, W. W .Rohn, incorporators.

A company with a capital of $100,000 is being formed in Baltimore, Md., for the purpose of manufacturing mantels. George H. Harrington, of G. H. Harrington & Bro., will be president of the new concern.

The National Tube Company is said to be making arrangements for the construction of a new blast furnace and other improvements at the plant in Benwood, W. Va., which will involve an expenditure of $1,000,000.

The Eberman-Bailey Brass Works, Jamestown, N. Y., has been formed to erect a brass foundry. H. J. Eberman and J. A. Bailey, formerly with the Art Metal Construction Company, Jamestown, comprise the new concern.

The foundry, enameling and grinding rooms of the Indiana Manufacturing Company, at the Indiana Reformatory, Jeffersonville, Ind., were destroyed by fire, causing a loss of over $125,000. The company manufactured hollow ware.

The B. & R. Motor Company, Queen's Wharf, Circular Quay, Sydney, Australia, will shortly be in the market for lathes, milling machines, drills, grinders and other tools for use in the manufacture of automobile and launch engines.

The Holm Manufacturing Company, Sparta, Mich., has been incorporated with $100,000 capital. The plant, now being erected, will consist of foundry, machine shop, pattern room, etc. P. J. Holm, formerly connected with the Northwestern Steel and Iron Works, Eau Claire, Wis., is president.

The Pneumatic Nut Machine Company, Cleveland, Ohio, has been incorporated to sell a new pneumatic machine for making nuts. Mather & Waechter, Cleveland, Ohio, who have secured control of the machine will build same. It is said this company will erect a new plant in the spring. Incorporaters, W. H. H. Mather, V. L. Waechter, C. E. Bullock, and others.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open the following bids: Jan. 19—engine lathe, pipe threader and cutter (schedule 775), 23-inch turret lathe, 12-inch turret lathe (schedule 774); Jan. 26—bolts and nuts (schedules 760, 738), twist drills, (schedule 739), files (schedule 741), steel (schedule 748), steel (schedule 723), solder (schedule 719); Feb. 2—traveling crane (schedule 765); Feb. 9 electrical equipment (schedule 766).

Want Advertisements

Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendation or other papers of value should not be inclosed to unknown correspondents. Only bona fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.

Miscellaneous Wants

Caliper list free. E. G. Smith Co., Columbia, Pa.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACH.

Hand power bending tools, labor-saving, money-making. Estep & Dolan, Sandwich, Ill.

Draftsmen, change your T-square to a parallel device; $2.50. F. G. Hobart, Beloit, Wis.

Light fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Special machinery accurately built. Screw machine or turret lathe work solicited. Robert J. Emory & Co., Newark, N. J.

Machines designed; automatic, special. Practical working drawings. C. W. Pitman, 3519 Frankford Ave., Philadelphia, Pa.

Will accept good patent right, in part payment for real estate. Give particulars and price. Box 121, Cincinnati, Ohio.

Wanted—Left hand second-hand Corliss engine in first-class condition to develop 100 to 150 horsepower. Box 789, AMER. MACH.

Special machinery and duplicate machine parts built to order; tools, jigs and experimental work; complete modern equipment. MacCordy Mfg. Co., Amsterdam, N. Y.

Wanted—Articles to manufacture by contract or will buy patent, tools and fixtures outright, by a manufacturer having a large and well equipped plant and capital. Address Box 564, Erie, Penn.

A large English firm of machine-tool importers having showrooms and offices in Great Britain, France, Italy and Japan, is wanting good agencies for machine tools of all kinds. Apply Box 189, AMER. MACH.

New patent laws. A firm of high-class machine toolmakers with modern plant (including foundry) are prepared to undertake the manufacture of suitable patented specialties on behalf of foreign patentees who are desirous of complying with the new patent laws. Roberts Bros., Dukinfield, Manchester, England.

The annual meeting of the stockholders of the Hill Publishing Company, for the election of directors for the ensuing year and for the transaction of such other business as may properly come before the meeting, will be held at the office of the company, in the Hallenbeck building, 497-505 Pearl street, Borough of Manhattan, New York City, N. Y., on Tuesday, January 26, 1909, at 12 o'clock noon. Dated, New York City, December 19th, 1908. Robert McKean, Secretary.

Situations Wanted

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

Superintendent who can make profits wants change. Box 773, AMER. MACHINIST.

ILLINOIS

Tool room foreman desires change; first class on tools for adding machines, cash registers and typewriters. Box 764, AM. MACH.

Mechanical draftsman, eight years' experience on jigs, dies and special tools for typewriter, adding machine and light interchangeable work. Box 755, AMER. MACHINIST.

MASSACHUSETTS

I wish to correspond with any company desiring the services of a progressive and up-to-date manufacturing superintendent. Box 701, AMERICAN MACHINIST.

Wanted—Position as manager or manager's assistant in machine shop; thirteen years' experience. Can bring a very desirable manufacturing business. Box 778, AMER. MACH.

NEW YORK

Draftsman, expert originator and designer of automatic machinery; $25 weekly. Box 785, AMERICAN MACHINIST.

Mechanical engineer, 20 years' experience, executive ability, selling and shop practice, good designer, desires engagement. Box 790, AMERICAN MACHINIST.

Mechanical draftsman desires position, four years' shop and four years' office experience, machine design, power plants, etc.; technical. Box 786, AMERICAN MACHINIST.

Tool-room foreman or assistant A-1 toolmaker, 14 years' practical experience on all kind of press tools and manufacturing; last 3½ years as foreman; age 31; at liberty February 1. Box 794, AMERICAN MACHINIST.

PENNSYLVANIA

Mechanical, structural draftsman, 27, technical graduate, five years' practical experience, wants work. Box 738, AM. MACHINIST.

Help Wanted

Classification indicates present address of advertiser, nothing else.

CONNECTICUT

Wanted—A first class mechanical draftsman, one familiar with elevator construction preferred. Give references, experience and salary expected. Box 760, AMER. MACHINIST.

ILLINOIS

Wanted—Machinery supply salesman to handle a crackerjack machinery specialty, either on salary, commission or as side line. Give particulars in first letter. Box 758, AMERICAN MACHINIST.

Wanted—Superintendent of machine shop, capable of checking detail drawings, designing tools, modern shop practice, with experience in building bottling machinery. State education, experience and salary wanted. Apply to Goetze & Floden Mfg. Co., 109-133 W. Chicago Ave., Chicago, Ill.

INDIANA

Wanted—Two inspectors, two grinders, six lathe men, two toolmakers, one foreman, four machinists, all for work on gasolene motors. Good wages. Box 666, AMER. MACHINIST.

MASSACHUSETTS

Wanted—Two pump draftsmen with wide experience on direct-acting and flywheel pumping engines and air compressors; those with technical education preferred. Address "Pump." Box 776, AMERICAN MACHINIST.

Wanted—Foreman for tool and repair department; good mechanic with experience in making cutters, hobs and forming tools, and doing repair work on general machinery. State age, experience and wages expected. Box 781, AMERICAN MACHINIST.

Wanted—Foreman capable of handling about 20 men and produce the best kind of machine tool work of milling machine quality in the quickest possible time. A good opening for the right man. Box 783, AM. MACH.

Wanted—Man in office of gear cutting shop as general assistant to manager; must have good mechanical judgment, and be quick at figures. One experienced in gear business preferred. State age, experience and salary expected. Box 782, AMERICAN MACHINIST.

MICHIGAN

Wanted—A man to operate National Acme screw machine; must have had large experience. When answering, state wages expected. Hancock Mfg. Co., Charlotte, Michigan.

Wanted—An assistant manager for Western machine shop, a man experienced in office work, also in selling and manufacturing gasolene engines. Write fully. Photograph desired. Box 795, AMERICAN MACHINIST.

Wanted—General foreman of machine work by boiler and radiator company. Man will be in charge over department foremen and must have good executive ability; must be a first-class mechanic and must be able to produce the best possible results. Give age, experience and references. Box 779, AM. MACH.

NEW ENGLAND

Wanted—A machine tool salesman who is a mechanic and diplomat, to sell one tool. A good opening for a man who has the making of a specialist. Box 792, AM. M.

NEW JERSEY

Draftsman wanted, with marine gasolene engine experience. Box 784, AMER. MACH.

Wanted—Draftsman on special machinery; must have shop and drawing room experience. Man with executive ability preferred. State age, experience and give reference and salary. Box 788, AMERICAN MACHINIST.

NEW YORK

Wanted—Foreman machinist to take charge of about 25 men in erecting department. Experience on stamping presses desirable. State experience and references. Box 793, AMERICAN MACHINIST.

Wanted, machinists—First-class men used to good class of work, similar to automatic machine tools; on planer, lathe, milling machine, vise and floor. Also good man on Landis grinder. State full particulars; age, apprenticeship, references, pay expected, etc., to "Industry," Box 796, AMER. MACHINIST.

Wanted—A mechanical man capable of finding and describing in a popular way, but correct mechanically, for laymen, the interesting and new inventions, machines, etc., that are being built and introduced into every line of human endeavor. Permanent and remunerative place for a live one. Box 774, AMERICAN MACHINIST.

OHIO

Toolmaker; one competent to make tools for rolling and drawing sheet metal. Box 791, AMERICAN MACHINIST.

WISCONSIN

Shop superintendent wanted in the manufacture of lubricating specialties. Must have ability to get up new designs. State experience and salary expected. Box 762, AM. M.

For Sale

Garvin No. 3 hand-feed milling machine. I. F. Wales, Keene, N. H.

For Sale—One second-hand Wheeler planer, 22x5 ft., $125. S. M. Langston, Camden, N. J.

Two and fifteen-sixteenths inch cold rolled steel shafting. We will cut to any desired length up to 4' 6". Ask for prices. Box 768, AMERICAN MACHINIST.

Established machine and forge shop on Long Island, suitable manufacture light machinery; $5000. Owner retiring. Box 787, AMERICAN MACHINIST.

For Sale, absolutely new, a No. 2½ heading machine and a No. 2½ reheading machine, Waterbury-Farrel make, never used. Ohlen Company, Box 740, Columbus, Ohio.

Rights of a new construction for pulleys, vehicle wheels, etc., stronger, lighter and cheaper than any in the market; will sell or work on royalty. Box 780, AMER. MACH.

For Sale—A solid brick, steel construction, factory building, with 7½ acres of land near Chicago. Now unoccupied. Size 110x541. Suitable for iron working business. Has engine, boilers, dynamos, etc. Most favorable prices and terms will be given. Chicago Highlands Association, 1315 Wells Building, Milwaukee, Wis.

English factory for sale covering about 6500 square yards and additional 10,000 square yards for extensions. 130 horsepower gas engines and up to date machinery, suitable for light manufacturing work of any kind. Factory situated in largest manufacturing center of the Midlands. Owners are open to manufacture and distribute under direct supervision large quantities of patented articles. Hill, Cawney House, Dudley, Worcestershire, England.

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Abrasive Materials
Abrasive Material Co., Phila., Pa.
American Emery Wheel Co., Providence, R. I.
Carborundum Co., Niagara Falls, N. Y.
Dickinson, Thos. L., New York.
Norton Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.
Vitrified Wheel Co., Westfield, Mass.

Air Lifts
Ingersoll-Rand Co., New York.

Alundum
See Grinding Wheels.

Arbor Presses
Barnes Co., W. F. & John, Rockford, Ill.
Marshall & Huschart Machinery Co., Chicago, Ill.
Niles-Bement-Pond Co., New York.
Wilmarth & Morman Co., Grand Rapids, Mich.

Arbors
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt Chuck Co., Frankfort, N. Y.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Union Twist Drill Co., Athol, Mass.
Wilmarth & Morman Co., Grand Rapids, Mich.

Barrels, Steel
Lyon Metallic Mfg. Co., Aurora, Ill.

Bars, Boring
Beaman & Smith Co., Prov., R. I.
Cleveland Twist Drill Co., Cleveland, O.
Elmes Engineering Works, Chas. F., Chicago, Ill.
Krieger Tool & Mfg. Co., Chicago, Ill.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Underwood Co., H. B., Philadelphia, Pa.

Bearings, Ball and Roller
Boston Gear Works, Norfolk Downs, Mass.
Grant-Hoover Ball Co., Merchantville, N. J.
Hess-Bright Mfg. Co., Philadelphia, Pa.
Hyatt Roller Bearing Co., Harrison, N. J.

Balls, Steel
Grant Hoover Ball Co., Merchantville, N. J.

Belt Dressing
Cling-Surface Mfg. Co., Buffalo, N. Y.
Desmond-Stephan Mfg. Co., Urbana, Ohio.
Dixon Crucible Co., Joseph, Jersey City, N. J.
Schieren Co., Chas. A., New York.
Shultz Belting Co., St. Louis, Mo.

Belt Fasteners
Bristol Co., Waterbury, Conn.

Belt Filler
Schieren Co., Chas. A., New York.
Shultz Belting Co., St. Louis, Mo.

Belt Lacing Machines
Birdsboro Steel Foundry & Mach. Co., Birdsboro, Pa.

Belt Shifter
The L. & D. Co., Boston, Mass.

Belting, Leather
Chicago Raw Hide Mfg. Co., Chicago, Ill.
Schieren Co., Chas. A., New York.
Shultz Belting Co., St. Louis, Mo.

Benches, Work
Manufacturing Equipment & Engineering Co., Boston, Mass.

Bending Machinery, Hydraulic
Niles-Bement-Pond Co., New York.
Sellers & Co., Inc., Wm., Phila., Pa.
Watson-Stillman Co., New York.

Bending Machines, Plate
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass.

Bending Machines, Power
Bethlehem Foundry & Machine Co., South Bethlehem, Pa.
Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

Bending Tools, Hand
Estep & Dolan, Sandwich, Ill.
Wallace Supply Co., Chicago, Ill.

Blocks, Chain
See Hoists, Hand.

Blocks, Die
Nicholson & Co., W. H., Wilkes-Barre, Pa.

Blowers
American Gas Furnace Co., New York.
Chicago Flexible Shaft Co., Chicago, Ill.
General Electric Co., New York.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Roth Bros. & Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.

Bolt and Nut Machinery
Acme Mchry. Co., Cleveland, O.
Davis Machine Co., W. P., Rochester, N. Y.
Foote-Burt Co., Cleveland, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Landis Machine Co., Waynesboro, Pa.
Manville Mach. Co., E. J., Waterbury, Conn.
McCabe, J. J., New York.
Milton Mfg. Co., Milton, Pa.
Mummert, Wolf & Dixon Co., Hanover, Pa.
National-Acme Mfg. Co., Cleveland, O.
National Machinery Co., Tiffin, O.
Newton Machine Tool Wks., Inc., Phila., Pa.
New Haven Mfg. Co., New Haven, Conn.
Niles-Bement-Pond Co., New York.
Northern Electrical Mfg. Co., Madison, Wis.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Standard Engineering Works, Ellwood City, Pa.
Vandyck Churchill Co., New York.
Waterbury Farrel Fdry. & Mach. Co., Waterbury, Conn.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Bolt Heads
Lang Co., G. R., Meadville, Pa.

Bolts and Nuts
Electric Welding Products Co., Cleveland, Ohio.
Milton Mfg. Co., Milton, Pa.
National-Acme Mfg. Co., Cleveland, O.

Bone for Case Hardening
Rogers & Hubbard Co., Middletown, Conn.

Books, Technical
American School of Correspondence, Chicago, Ill.
Hill Publishing Co., New York.
Sames, Chas. M., Jersey City, N. J.

Boosters
Burke Electric Co., Erie, Pa.
C & C Electric Co., New York.
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Roth Bros. & Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Pittsburg, Pa.

Boring and Drilling Machines, Horizontal
Barnes Co., W. F. & John, Rockford, Ill.
Beaman & Smith Co., Prov., R. I.
Betts Mach. Co., Wilmington, Del.
Detrick & Harvey Mach. Co., Wilmington, Del.
Fitchburg Machine Works, Fitchburg, Mass.
Fosdick Mach. Tool Co., Cin., O.
Gisholt Mach. Co., Madison, Wis.
Hill, Clarke & Co., Inc., Boston, Mass.
Lucas Mach. Tool Co., Cleveland, O.
McCabe, J. J., New York.
Motch & Merryweather Machinery Co., Cleveland, O.
New Haven Mfg. Co., New Haven, Conn.
Newton Mach. Tool Works, Inc., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Rockford Drilling Mach. Co., Rockford, Ill.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Universal Boring Mach. Co., Hudson, Mass.
Vandyck Churchill Co., New York.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.

Boring and Turning Mills, Vertical
American Tool Works Co., Cin., O.
Baker Bros., Toledo, O.
Baush Mach. Tool Co., Springfield, Mass.
Betts Mach. Co., Wilmington, Del.
Bullard Mach. Tool Co., Bridgeport, Conn.
Colburn Mach. Tool Co., Franklin, Pa.
Gisholt Mach. Co., Madison, Wis.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
McCabe, J. J., New York.
Mitts & Merrill, Saginaw, Mich.
Newton Machine Tool Wks., Inc., Phila., Pa.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Vandyck Churchill Co., New York.

Boring Tools
Armstrong Bros. Tool Co., Chicago, Ill.
Krieger Tool & Mfg. Co., Chicago, Ill.

Box Tools, Roughing
Bardons & Oliver, Cleveland, O.

Brazing
Industrial Oxygen Co., New York.
Sanford Mfg. Co., F. C., Bridgeport, Conn.
Universal Fluxine Co., Urbana, Ohio.

Broaching Machines
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hill, Clarke & Co., Inc., Boston, Mass.
Lapointe Mach. Tool Co., Hudson, Mass.

Bulldozers
Bliss Co., E. W., Brooklyn, N. Y.
National Machinery Co., Tiffin, O.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.

Cabinets, Tool
Armstrong Bros. Tool Co., Chicago, Ill.
Hammacher, Schlemmer & Co., New York.
Morse Twist Drill & Mach. Co., New Bedford, Mass.

Calipers
Brown & Sharpe Mfg. Co., Providence, R. I.
Schuchardt & Schutte, New York.
Slocomb Co., J. T., Providence, R. I.
Starrett Co., L. S., Athol, Mass.

Cams
Bilgram, Hugo, Phila., Pa.
Boston Gear Works, Norfolk Downs, Mass.
Fuller Mfg. Co., New Haven, Ct.

Carborundum
See Grinding Wheels.

Carborundum Paper and Cloth
Carborundum Co., Niagara Falls, N. Y.

Case-Hardening
American Gas Furnace Co., New York.
Rogers & Hubbard Co., Middletown, Conn.
Williams & Co., J. H., Brooklyn, N. Y.

Castings, Brass and Bronze
Clum & Atkinson, Rochester, N. Y.
Lumen Bearing Co., Buffalo, N. Y.

Castings, Die Molded
Berry & Parker, Erie, Pa.
Franklin Mfg. Co., H. H., Syracuse, N. Y.

Castings, Iron
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Cell Drier Machine Co., Taunton, Mass.
Farrel Fdry. & Mach. Co., Ansonia, Conn.
Taylor & Fenn Co., Hartford, Conn.

Castings, Steel
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Cammell Laird & Co., New York

Cast Iron Brazing
Industrial Oxygen Co., New York.

Cement, Cast Steel
Clark Cast Steel Cement Co., Shelton, Conn.
Obermayer & Co., S., Cincinnati, O.

Centering Machines
Hendey Mach. Co., Torrington, Conn.
McCabe, J. J., New York.
National Machine Co., Hartford, Conn.
Niles-Bement Pond Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Whiton Mach. Co., D. E., New London, Conn.

Centers, Planer
Cincinnati Planer Co., Cincinnati, O.
Fay & Scott, Dexter, Me.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
New Haven Mfg. Co., New Haven, Conn.
Pratt & Whitney Co., Hartford, Conn.
Woodward & Powell Planer Co., Worcester, Mass.

Chains, Driving
Boston Gear Works, Norfolk Downs, Mass.
Diamond Chain & Mfg. Co., Indianapolis, Ind.
Link-Belt Co., Philadelphia, Pa.
Morse Chain Co., Ithaca, N. Y.
Whitney Mfg. Co., Hartford, Conn.

Chucking Machines
American Tool Wks. Co., Cin., O.
Bardons & Oliver, Cleveland, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., Cleveland, O.
Gisholt Machine Co., Madison, Wis.
LeBlond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Reed Co., F. E., Worcester, Mass.
Warner & Swasey Co., Cleveland, Ohio.
Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass.
Windsor Mach. Co., Windsor, Vt.

Chucks, Drill
Almond Mfg. Co., T. R., Ashburnham, Mass.
Brown & Co., R. H., New Haven, Conn.
Celfor Tool Co., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, O.
Cushman Chuck Co., Hartford, Conn.
Horton & Son Co., E., Windsor Locks, Conn.
Jacobs Mfg. Co., Hartford, Conn.
Modern Tool Co., Erie, Pa.
Morrow Mfg. Co., Elmira, N. Y.

Chucks, Drill —*Continued.*

Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt Chuck Co., Frankfort, N. Y.
Russell Anti-friction Drill Chuck Co., Elmira, N. Y.
Skinner Chuck Co., New Britain, Conn.
Standard Tool Co., Cleveland, O.
Trump Bros. Mach. Co., Wilmington, Del.
Union Mfg. Co., New Britain, Conn.
Whitman & Barnes Mfg. Co., Chicago, Ill.
Whitney Mfg. Co., Hartford, Conn.
Whiton Mach. Co., D. E., New London Conn.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Chucks, Lathe

Cincinnati Chuck Co., Cincinnati, O.
Cushman Chuck Co., Hartford, Conn.
Gisholt Mach. Co., Madison, Wis.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Horton & Son Co., E., Windsor Locks, Conn.
Niles-Bement-Pond Co., New York.
Pratt Chuck Co., Frankfort, N. Y.
Russell Anti-friction Drill Chuck Co., Elmira, N. Y.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.
Whiton Mach. Co., D. E., New London, Conn.

Chucks, Planer

Cincinnati Planer Co., Cincinnati, O.
Harrington & Son Co., Edwin, Philadelphia, Pa.
New Haven Mfg. Co., New Haven, Conn.
Niles-Bement-Pond Co., New York.
Skinner Chuck Co., New Britain, Conn.
Union Mfg. Co., New Britain, Conn.

Chucks, Split

Hardinge Bros., Chicago, Ill.
Rivett Lathe Mfg. Co., Boston, Mass.
Sloan & Chace Mfg. Co., Ltd., Newark, N. J.

Circuit Breakers

Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., New York.
Western Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Pittsburg, Pa.

Clamps

Hammacher, Schlemmer & Co., New York.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
Starrett Co., L. S., Athol, Mass.
Tudor Mfg. Co., Taunton, Mass.

Clocks, Watchman's

Hardinge Bros., Chicago, Ill.

Clutches, Friction

American Tool & Machine Co., Boston, Mass.
Bliss Co., E. W., Brooklyn, N. Y.
Caldwell, Son & Co., H. W., Chicago, Ill.
Eastern Machinery Co., New Haven, Conn.
Evans Friction Cone Co., Newton Centre, Mass.
Farrel Fdry. & Mach Co., Ansonia, Conn.
Johnson Mach. Co., Carlyle, Hartford, Conn.
Link-Belt Co., Philadelphia, Pa.
New Haven Mfg. Co., New Haven, Conn.
Niles-Bement-Pond Co., New York.
Reeves Pulley Co., Columbus, Ind.
Williams Foundry & Machine Co., Akron, Ohio.

Coal Handling Machinery

Link-Belt Co., Philadelphia, Pa.

Compound, Core

Obermayer Co., S., Cincinnati, O.
Universal Fluxine Co., Urbana, O.

Compound, Pipe Joint

Dixon Crucible Co., Joseph, Jersey City, N. J.

Compressors, Air

Blaisdell Machinery Co., Bradford, Pa.
Bury Compressor Co., Erie, Pa.

Compressors, Air —*Continued.*

Clayton Air Compressor Works, New York.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.
Spacke Machine Co., F. W., Indianapolis, Ind.

Compressors, Gas

Blaisdell Machinery Co., Bradford, Pa.
Ingersoll-Rand Co., New York.

Cones, Friction

Evans Friction Cone Co., Newton Centre, Mass.

Connecting Rods and Straps

Standard Connecting Rod Co., Beaver Falls, Pa.

Contract Work

Blanchard Machine Co., Cambridge, Mass.
Cell Drier Mach. Co., Taunton, Mass.
Farrel Fdry. & Mach. Co., Ansonia, Conn.
Fuller Mfg. Co., New Haven, Ct.
Merritt, Jos., Hartford, Conn.
Morrow Mfg. Co., Elmira, N. Y.
Owen Machine Tool Co., Springfield, O.
Schaeffer Mach. Wks., Phila., Pa.
Turner Mach. Co., Danbury, Conn.

Controllers and Starters, Electric

Crocker-Wheeler Co., Ampere, N. J.
Cushman Electric Co., Concord, N. H.
General Electric Co., New York.
Westinghouse Electric & Mfg. Co., Pittsburg, Pa.

Conveyors, Automatic

Lamson Consolidated Store Service Co., Boston, Mass.
Link-Belt Co., Philadelphia, Pa.

Coping Machines

Long & Allstatter Co., Hamilton, Ohio.
Niles-Bement-Pond Co., New York.

Corundum

See Grinding Wheels.

Cotters

Cleveland Twist Drill Co., Cleveland, Ohio
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes Mfg. Co., Chicago, Ill.

Counterbores

Cleveland Twist Drill Co., Cleveland, Ohio.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Slocomb Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

Counters, Revolution

Root Co., C. J., Bristol, Conn.
Schuchardt & Schutte, New York.
Veeder Mfg. Co., Hartford, Conn.

Countershafts

Almond Mfg. Co., T. R., Ashburnham, Mass.
Builders Iron Foundry, Providence, R. I.
Coates Clipper Mfg. Co., Worcester, Mass.
Dill Slotter People, Phila., Pa.
Evans Friction Cone Co., Newton Centre, Mass.
LeBlond Mach. Tool Co., R. K., Cincinnati, O.
McCabe, J. J., New York.
Norton Grinding Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.
Smith Countershaft Co., Boston, Mass.

Countershafts, Friction

Dill Slotter People, Phila., Pa.
Evans Friction Cone Co., Newton Centre, Mass.
Wilmarth & Mormon Co., Grand Rapids, Mich.

Counting and Printing Wheels

Franklin Mfg. Co., H. H., Syracuse, N. Y.

Couplers, Hose

Independent Pneu. Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.

Couplings

Almond Mfg. Co., T. R., Ashburnham, Mass.
Caldwell & Son Co., H. W., Chicago, Ill.
Davis Machine Co., W. P., Rochester, N. Y.
Link-Belt Co., Philadelphia, Pa.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Niles-Bement-Pond Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Standard Gauge Steel Co., Beaver Falls, Pa.
Williams Fdry. & Mach. Co., Akron, Ohio.

Cranes

Brown Hoisting Mach. Co., Cleveland, O.
Case Mfg. Co., Columbus, O.
Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Manning, Maxwell & Moore, Inc., New York.
Maris Bros., Philadelphia, Pa.
Nicholls, Wm. S., New York.
Niles-Bement-Pond Co., New York.
Northern Engineering Works, Detroit, Mich.
Obermayer Co., S., Cincinnati, O.
Pawling & Harnischfeger, Milwaukee, Wis.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
Vandyck Churchill Co., New York.
Yale & Towne Mfg. Co., New York.

Crank Pin Turning Machines

Niles-Bement-Pond Co., New York.
Underwood & Co., H. B., Philadelphia, Pa.

Crank Shafts

Standard Connecting Rod Co., Beaver Falls, Pa.

Crucibles

Dixon Crucible Co., Joseph, Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

Crushers

Farrel Fdry. & Mach. Co., Ansonia, Conn.
Niles-Bement-Pond Co., New York.
Link-Belt Co., Philadelphia, Pa.

Cupolas and Ladles, Foundry

Obermayer Co., S., Cincinnati, O.
Paxson Co., J. W., Phila., Pa.

Cups, Grease

Lunkenheimer Co., Cincinnati, O.

Cutters, Milling

Adams Co., Dubuque, Iowa.
Becker Milling Machine Co., Hyde Park, Mass.
Boker & Co., Hermann, New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Hardinge Bros., Chicago, Ill.
Harrison & Knight Mfg. Co., Newark, N. J.
Ingersoll Milling Mach. Co., Rockford, Ill.
Kearney & Trecker, Milwaukee, Wis.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Owen Mach. Tool Co., Springfield, Ohio.
Pratt & Whitney Co., Hartford, Conn.
Rogers Works, Jno. M., Gloucester City, N. J.
Sloan & Chace Mfg. Co., Ltd., Newark, N. J.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.
Ward & Son, Edgar T., Boston, Mass.
Whitney Mfg. Co., Hartford, Conn.

Cutting-off Machines

Armstrong Bros. Tool Co., Chicago, Ill.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Davis Machine Co., W. P., Rochester, N. Y.
Hurlburt-Rogers Mach. Co., South Sudbury, Mass.
McCabe, J. J., New York.
Newton Mach. Tool Works, Inc., Philadelphia, Pa.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Vandyck Churchill Co., New York.

Cutting-off Tools

Armstrong Bros. Tool Co., Chicago, Ill.
Billings & Spencer Co., Hartford, Conn.
Cleveland Twist Drill Co., Cleveland, O.
Fitchburg Machine Works, Fitchburg, Mass.
Krieger Tool & Mfg. Co., Chicago, Ill.
O. K. Tool Holder Co., Shelton, Conn.
Pratt & Whitney Co., Hartford, Conn.

Diamond Tools

American Emery Wheel Co., Providence, R. I.
Dickinson, Thos. L., New York.
Safety Emery Wheel Co., Springfield, O.

Dies, Sheet Metal

American Tube & Stamping Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn, N. Y
Boston Tool Co., Cambridge, Mass.
Consolidated Press and Tool Co., Hastings, Mich.
Ferracute Mach. Co., Bridgeton, N. J.

Dies, Sub-Press

Sloan & Chace Mfg. Co., Newark, N. J.
Waltham Machine Works, Waltham, Mass.

Dies, Threading, Opening

Boker & Co., Hermann, New York.
Errington, F. A., New York.
Foote-Burt Co., Cleveland, O.
Geometric Tool Co., New Haven, Conn.
Jones & Lamson Machine Co., Springfield, Vt.
Pratt & Whitney Co., Hartford, Conn.

Drawing Boards and Tables

Alteneder & Son, Theo., Philadelphia, Pa.
Kolesch & Co., New York.

Drawing Materials

Alteneder & Son, Theo., Philadelphia, Pa.
Kolesch & Co., New York.

Drafting Machines

Universal Drafting Mach. Co., Cleveland, O.

Drilling Machines, Bench

American Watch Tool Co., Waltham, Mass.
Barnes Co., W. F. & John, Rockford, Ill.
Boynton & Plummer, Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.
Prentice Bros. Co., Worcester, Mass.
Rockford Drilling Mach. Co., Rockford, Ill.
Slate Machine Co., Dwight, Hartford, Conn.
Sloan & Chace Mfg. Co., Ltd., Newark, N. J.
U. S. Electrical Tool Co., Cincinnati, O.

Drilling Machines, Boiler

American Tool Works Co., Cin., O.
Bickford Drill & Tool Co., Cincinnati, O.
Foote-Burt Co., The, Cleveland, O.
Ingersoll-Rand Co., New York.
McCabe, J. J., New York.
Niles-Bement-Pond Co., New York.
Prentice Bros. Co., Worcester, Mass.
Sellers & Co., Inc., Wm., Phila., Pa.

Drilling Machines, Multiple Spindle

American Tool Wks. Co., Cin., O.
Baker Bros., Toledo, O.
Barnes Co., W. F. & John, Rockford, Ill.
Baush Mach. Tool Co., Springfield, Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Flather Planer Co., Mark, Nashua, N. H.
Foote-Burt Co., The, Cleveland, Ohio.
Fosdick Mach. Tool, Co., Cin., O.
Hardinge Bros., Chicago, Ill.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Henry & Wright Mfg. Co., Hartford; Conn.
Hill, Clarke & Co., Inc., Boston Mass.

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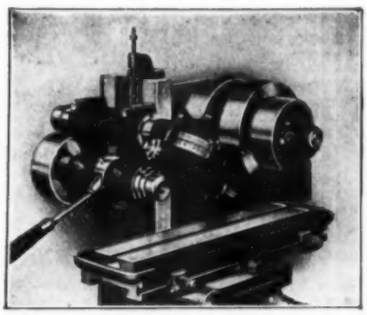
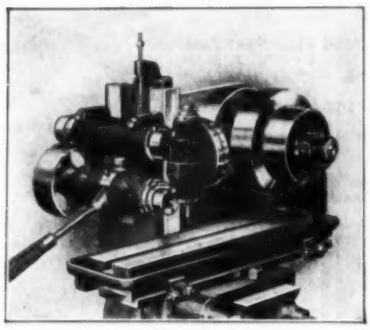
"Whitney" Chains have been used on many cars in the Vanderbilt and Briarcliff Cup Races and have never failed to make perfect records in these events.





This new Vertical Universal High Speed Milling Attachment makes the "Whitney" Hand Miller one of the most complete and desirable tools on the market for a wide range of work.

The Whitney Mfg. Co.,
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Drilling Machines, Multiple Spindle—*Continued.*

Marshall & Huschart Machry. Co., Chicago, Ill.
McCabe, J. J., New York.
National Machine Co., Hartford, Conn.
Newton Mach. Tool Works, Inc., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Prentice Bros. Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Rockford Drilling Mach. Co., Rockford, Ill.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Slate Machine Co., Dwight, Hartford, Conn.
Taylor & Fenn Co., Hartford, Conn.

Drilling Machines, Portable

Cincinnati Elec. Tool Co., Cin., O.
Coates Clipper Mfg. Co., Worcester, Mass.
Gem Mfg. Co., Pittsburg, Pa.
Hisey-Wolf Mach. Co., Cin., O.
Ingersoll-Rand Co., New York.
Newton Machine Tool Wks., Inc., Phila., Pa.
Niles-Bement-Pond Co., New York.
U. S. Electrical Tool Co., Cincinnati, O.

Drilling Machines, Radial

American Tool Works Co., Cin., O.
Baush Mach. Tool Co., Springfield, Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Dreses Mach. Tool Co., Cin., O.
Fitchburg Machine Works, Fitchburg, Mass.
Foote-Burt Co., Cleveland, O
Fosdick Mach. Tool Co., Cin., O.
Gang Co., Wm. E., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hilbert Mach. Co., Cincinnati, Ohio.
Marshall & Huschart Machry. Co., Chicago, Ill.
McCabe, J. J., New York.
Morris Foundry Co., Jno. B., Cincinnati, O.
Mueller Mach. Tool Co., Cin., O.
Newton Mach. Tool Wks., Inc., Phila., Pa.
Niles-Bement-Pond Co., New York.
Prentice Bros. Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Vandyck Churchill Co., New York.
Wormer Mchy. Co., C. C., Detroit, Mich.

Drilling Machines, Rail

Foote-Burt Co., Cleveland, O.
Newton Machine Tool Wks., Inc., Phila., Pa.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Phila., Pa.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
Standard Tool Co., Cleveland, O.

Drilling Machines, Turret

Fay Machine Tool Co., Phila., Pa.
Niles-Bement-Pond Co., New York.

Drilling Machines, Upright

American Tool Works Co., Cin. O.
Baker Bros., Toledo, O.
Barnes Co., W. F. & John, Rockford, Ill.
Beaman & Smith Co., Prov., R. I.
Celfor Tool Co., Chicago, Ill.
Cincinnati Mach. Tool Co., Cincinnati, O.
Davis Machine Co., W. P., Rochester, N. Y.
Fosdick Mach. Tool Co., Cin., O.
Foote-Burt Co., Cleveland, O.
Gould & Eberhardt, Newark, N. J.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Henry & Wright Mfg. Co., Hartford, Conn.
Hill, Clarke & Co., Inc., Boston, Mass.
Hoefer Mfg. Co., Freeport, Ill.
Kern Mach. Tool Co., Cincinnati, O.
Knight Machry. Co., W. B., St. Louis, Mo.
Marshall & Huschart Machry. Co., Chicago, Ill.
McCabe, J. J., New York.
Mechanics Machine Co., Rockford, Ill.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
New Haven Mfg. Co., New Haven, Conn.
Niles-Bement-Pond Co., New York.
Prentice Bros. Co., Worcester, Mass.

Drilling Machines Upright

Prentiss Tool & Supply Co., New York.
Rockford Drilling Mach. Co. Rockford, Ill.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Sibley Machine Tool Co., South Bend, Ind.
Slate Mach. Co., Dwight, Hartford, Conn.
Sloan & Chace Mfg. Co., Newark, N. J.
Taylor & Fenn Co., Hartford, Conn.
Vandyck Churchill Co., New York.
Whitney Mfg. Co., Hartford, Conn.
Wiley & Russell Mfg. Co., Greenfield, Mass.
Wormer Mchry. Co., C. C., Detroit, Mich.

Drills, Center

Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Machine Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Slocomb Co., J. T., Prov., R. I.
Standard Tool Co., Cleveland, O.

Drills, Electric

Independent Pneumatic Tool Co., Chicago, Ill.
Van Dorn Elec. Co., Cleveland, Ohio.

Drills, Flat

Celfor Tool Co., Chicago, Ill.
Lincoln Williams Twist Drill Co., Taunton, Mass.
Whitman & Barnes Mfg. Co., Chicago, Ill.

Drills, Hand

Cincinnati Electrical Tool Co., Cincinnati, O.
Coates Clipper Mfg. Co., Worcester, Mass.
Hisey-Wolf Mach. Co., Cin., O.
Ingersoll-Rand Co., New York.
Niles-Bement-Pond Co., New York.
U. S. Electrical Tool Co., Cincinnati, O.

Drills, Pneumatic

Clayton Air Compressor Works, New York.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.

Drills, Ratchet

Armstrong Bros. Tool Co., Chicago, Ill.
Boker & Co., Hermann, New York.
Cleveland Twist Drill Co., Cleveland, O.
Hisey-Wolf Mach. Co., Cin., O.
Parker Co., Chas., Meriden, Conn.
Pratt & Whitney Co., Hartford, Conn.
Rogers Works, John M., Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

Drills, Rock

Ingersoll-Rand Co., New York.
Northern Electrical Mfg. Co., Madison, Wis.

Drill Speeder

Graham Mfg. Co., Providence, R. I.

Drying Apparatus

Sturtevant Co., B. F., Hyde Park, Mass.

Dynamos

Burke Electric Co., Erie, Pa.
C & C Electric Co., New York.
Crocker-Wheeler Co., Ampere, N. J.
Eck Dynamo & Motor Co., Belleville, N. J.
Electro Dynamic Co., Bayonne, N. J.
General Electric Co., New York.
Jantz & Leist Elec. Co., Cin., O.
Northern Elec. Mfg. Co., Madison, Wis.
Roth Bros. & Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.
Triumph Electric Co., Cincin., O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburg, Pa.

Electrical Supplies

Crocker-Wheeler Co., Ampere, N. J.
Cushman Electric Co., Concord, N. H.
Electro Dynamic Co., Bayonne, N. J.
General Electric Co., New York.
Jantz & Leist Elec. Co., Cincinnati, O.
Northern Elec. Mfg. Co., Madison, Wis.

Electrical Supplies—*Cont.*

Roth Bros. & Co., Chicago, Ill.
Triumph Electric Co., Cincinnati, O.
Van Dorn Elec. & Mfg. Co., Cleveland, O.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburg, Pa.

Electrically Driven Tools and Machinery

American Tool Works Co., Cin., O.
Cincinnati Electrical Tool Co., Cincinnati, O.
Cushman Electric Co., Concord, N. H.
Electro Dynamic Co., Bayonne, N. J.
Hisey-Wolf Mach. Co., Cincin., O.
Ransom Mfg. Co., Oshkosh, Wis.
Roth Bros. & Co., Chicago, Ill.
U. S. Electrical Tool Co., Cincinnati, O.
Van Dorn Elec. & Mfg. Co., Cleveland, O.
Wiley Machine Co., Jeffersonville, Ind.
Western Electric Co., Chicago, Ill.

Elevators

Albro-Clem Elevator Co., Philadelphia, Pa.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Link-Belt Co., Philadelphia, Pa.

Emery Wheels

See Grinding Wheels.

Emery Wheel Dressers

American Emery Wheel Co., Providence, R. I.
Bay State Stamping Co., Worcester, Mass.
Desmond-Stephan Mfg. Co., Urbana, O.
Diamond Saw & Stamping Works, Buffalo, N. Y.
Dickinson, Thos. L., New York.
Safety Emery Wheel Co., Springfield, O.
Standard Tool Co., Cleveland, O.
Vitrified Wheel Co., Westfield, Mass.
Wrigley Co., Thos., Chicago, Ill.

Enclosures, Tool-room

Hart & Cooley Co., New Britain, Conn.

Engineering Appliances

Crosby Steam Gage & Valve Co., Boston, Mass.
Lunkenheimer Co., Cincinnati, O.

Engineers, Mechanical and Electrical

Crocker-Wheeler Co., Ampere, N. J.
Merritt, Jos., Hartford, Conn.

Engines, Gas and Gasolene

Automatic Mach. Co., Bridgeport, Conn.
Blaisdell Machinery Co., Bradford, Pa.
Grant Mfg. & Mach. Co., Bridgeport, Conn.

Engines, Motor

Franklin Mfg. Co., H. H., Syracuse, N. Y.

Engines, Steam

Sturtevant Co., B. F., Hyde Park, Mass.

Engraving Machinery

Gorton Mach. Co., Geo., Racine, Wis.

Exhaust Heads

Sturtevant Co., B. F., Hyde Park, Mass.

Expanders, Tube

Nicholson & Co., W. H., Wilkes-Barre, Pa.

Factory Sites

Rahway Valley R. R., New York.

Fans, Electric

Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., New York.
Northern Elec. Mfg. Co., Madison, Wis.
Sturtevant Co., B. F., Hyde Park, Mass.
Westinghouse Electric & Mfg. Co., Pittsburg, Pa.

Fans, Exhaust

Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., New York.
Sturtevant Co., B. F., Hyde Park, Mass.
Western Electric Co., Chicago, Ill.

Files and Rasps

Barnett Co., G. & H., Phila., Pa.
Carver File Co., Philadelphia, Pa.
Hammacher, Schlemmer & Co., New York.
National File and Tool Co., Philadelphia, Pa.
Nicholson File Co., Prov., R. I.
Reichheim & Co., E. P., New York.
Simonds File Co., Fitchburg, Mass.

Filing Machines

Henry & Wright Mfg. Co., Hartford, Conn.

Filler, Iron

Clark Cast Steel Cement Co., Shelton, Conn.
Felton, Sibley & Co., Philadelphia, Pa.

Flexible Shafts

Chicago Flexible Shaft Co., Chicago, Ill.
Coates Clipper Mfg. Co., Worcester, Mass.
Gem Mfg. Co., Pittsburg, Pa.

Forges

Bradley & Son, C. C., Syracuse, N. Y.
National Machinery Co., Tiffin, O.
Prentiss Tool & Supply Co., New York.
Sturtevant Co., B. F., Hyde Park, Mass.

Forgings, Drop

Billings & Spencer Co., Hartford, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Brown & Co., R. H., New Haven, Conn.
O. K. Tool Holder Co., Shelton, Conn.
Williams & Co., J. H., Brooklyn, N. Y.

Forgings, Steel

Cammell Laird & Co., New York.

Foundry Furnishings

Adams Co., Dubuque, Iowa.
Goldschmidt Thermit Co., New York.
Obermayer Co., S., Cincinnati, O.
Paxson Co., J. W., Phila., Pa.
Sturtevant Co., B. F., Hyde Park, Mass.

Frictions, Paper and Iron

Rockwood Mfg. Co., Indianapolis, Ind.

Furnaces, Annealing and Tempering

American Gas Furnace Co., New York.
Chicago Flexible Shaft Co., Chicago, Ill.
Hoskins Co., The, Chicago, Ill.
Tate, Jones & Co., Pittsburg, Pa.
Westmacott Gas Furnace Co., Providence, R. I.

Furnaces, Electric

Hoskins Co., The, Chicago, Ill.

Furnaces, Gas

American Gas Furnace Co., New York.
Chicago Flexible Shaft Co., Chicago, Ill.
Rockwell Furnace Co., New York.
U. S. Gas Furnace Co., Providence, R. I.
Westmacott Gas Furnace Co., Providence, R. I

Furnaces, Melting

American Gas Furnace Co., New York.
Chicago Flexible Shaft Co., Chicago, Ill.
Obermayer Co., S., Cincinnati, O.
Westmacott Gas Furnace Co., Providence, R. I.

Furnaces, Oil

Rockwell Furnace Co., New York.
Tate, Jones & Co., Pittsburg, Pa.
Westmacott Gas Furnace Co., Providence, R. I.

Furnaces, Welding

Industrial Oxygen Co., New York.
Sanford Mfg. Co., F. C., Bridgeport Conn.

Furniture, Machine Shop

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Manufacturing Equip. & Engineering Co., Boston, Mass.
Merritt & Co., Philadelphia, Pa.

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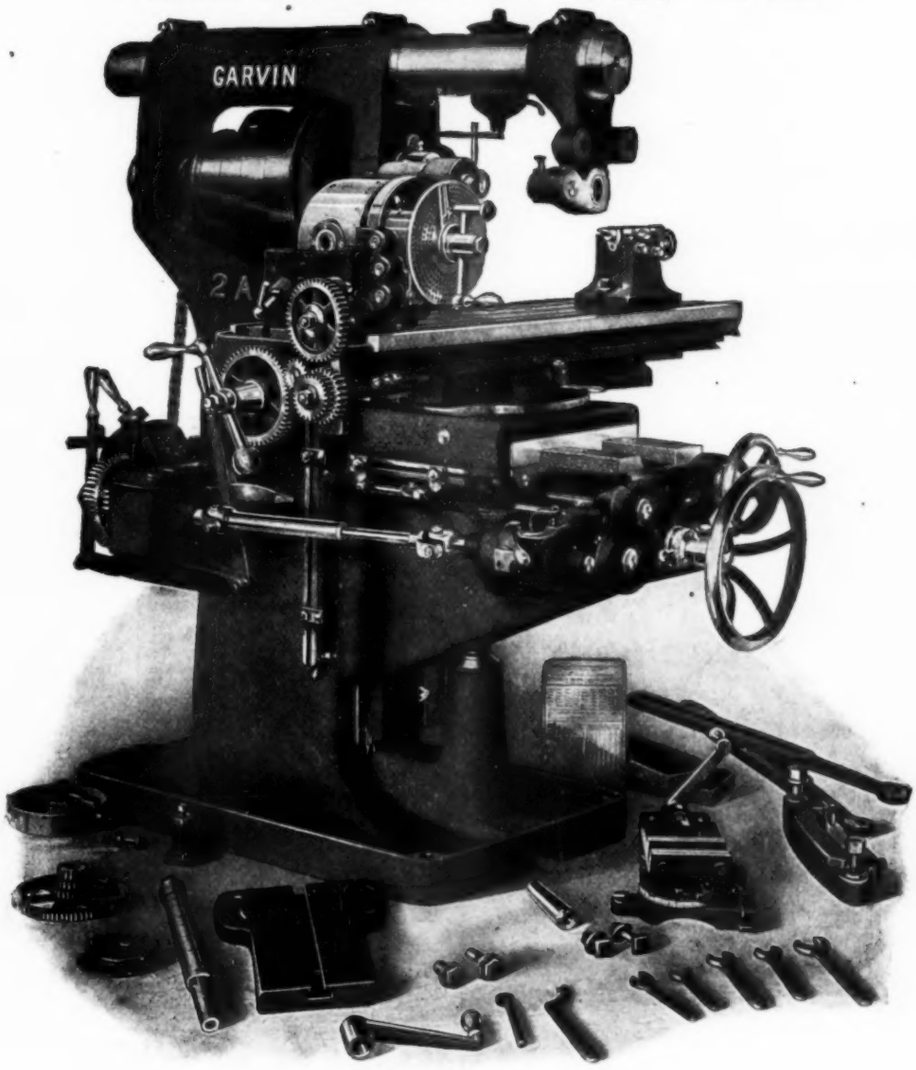
IMMEDIATE



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No. 2A (All Feeds) Universal Milling Machine

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Gages, Recording

Bristol Co., Waterbury, Conn.

Gages, Standard

Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Henry & Wright Mfg. Co., Hartford, Conn.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn
Rogers Wks., Jno. M., Gloucester City, N. J.
Slocomb Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

Gages, Steam

Bristol Co., Waterbury, Conn.
Crosby Steam Gage & Valve Co., Boston, Mass.

Gear Cutting Machinery

Adams Co., Dubuque, Iowa.
American Watch Tool Co., Waltham, Mass.
Becker Milling Machine Co., Hyde Park, Mass.
Bickford Drill & Tool Co., Cincinnati, O.
Bilgram, Hugo, Philadelphia, Pa.
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Cincinnati Shaper Co., Cincinnati, Ohio.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, N. Y.
Gould & Eberhardt, Newark, N. J.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
McCabe, J. J., New York.
Newark Gear Cutting Machine Co., Newark, N. J.
Newton Machine Tool Works, Inc., Philadelphia, Pa
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Schuchardt & Schutte, New York.
Slate Machine Co., Dwight, Hartford, Conn.
Sloan & Chace Mfg. Co., Newark, N. J.
Spacke Mach. Co., F. W., Indianapolis, Ind.
Van Dorn & Dutton Co., Cleveland, Ohio.
Walcott & Wood Mach. Tool Co., Jackson, Mich.
Waltham Machine Works, Waltham, Mass.
Whiton Machine Co., D. E., New London, Conn.

Gear Testing Machinery

Gisholt Mach. Co., Madison, Wis.

Gears, Cut

Bilgram, Hugo, Philadelphia, Pa.
Boston Gear Works, Norfolk Downs, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Caldwell & Son Co., H. W., Chicago, Ill.
Chicago Raw Hide Mfg. Co., Chicago, Ill.
Davis, Rodney, Philadelphia, Pa.
Earle Gear & Machine Co., Philadelphia, Pa.
Farrel Fdry. & Mach. Co., Ansonia, Conn.
Fawcus Mach. Co., Pittsburg, Pa.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, Rochester, Mass.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Hardinge Bros., Chicago, Ill.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Horsburgh & Scott Co., The. Cleveland, Ohio.
Lee Equipment Co., New York.
Newark Gear Cutting Machine Co., Newark, N. J.
New Process Rawhide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburg, Pa.
Owen Machine Tool Co., Springfield, Ohio.
Philadelphia Gear Works, Philadelphia, Pa.
Sawyer Gear Works, Cleveland, O.
Spacke Mach. Co., F. W., Indianapolis, Ind.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
Van Dorn & Dutton Co., Cleveland, O.

Gears, Cut—*Continued.*

Walcott & Wood Mach. Tool Co., Jackson, Mich.
Woburn Gear Works, Woburn, Mass.

Gears, Molded

Caldwell & Son Co., H. W., Chicago, Ill.
Farrel Fdry. & Mach. Co., Ansonia, Conn.
Franklin Mfg. Co., H. H., Syracuse, N. Y.
Horsburg & Scott Co., The, Cleveland, Ohio.
Philadelphia Gear Works, Philadelphia, Pa.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
Van Dorn & Dutton Co., Cleveland, O.

Gears, Quride

Picrome Hide Co., Syracuse, N. Y.

Gears, Rawhide

Boston Gear Works, Norfolk Downs, Mass.
Chicago Raw Hide Mfg. Co., Chicago, Ill.
Earle Gear & Mach. Co., Philadelphia, Pa.
Fawcus Mach. Co., Pittsburg, Pa.
Gould & Eberhardt, Newark, N. J.
Grant Gear Works, Boston, Mass.
Horsburgh & Scott Co., The, Cleveland, O.
New Process Rawhide Co., Syracuse, N. Y.
Nuttall Co., R. D., Pittsburg, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Sawyer Gear Works, Cleveland, O.
Van Dorn & Dutton Co., Cleveland, O.

Gears, Worm

Albro-Clem Elevator Co., Philadelphia, Pa.
Boston Gear Works, Norfolk Downs, Mass.
Farrel Fdry. & Mach. Co., Ansonia, Conn.
Fawcus Machine Co., Pittsburg, Pa.
Gould & Eberhardt, Newark, N. J.
Horsburgh & Scott Co., The, Cleveland, O.
Morse Williams & Co., Phila., Pa.
Newark Gear Cutting Machine Co., Newark, N. J.
Nuttall Co., R. D., Pittsburg, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Picrome Hide Co., Syracuse, N. Y.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
Van Dorn & Dutton Co., Cleveland, O.

Generating Sets

Burke Electric Co., Erie, Pa.
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., New York.
Northern Electrical Mfg. Co., Madison, Wis.
Roth Bros. & Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.
Triumph Electric Co., Cincinnati, O.

Generators, Gas

American Gas Furnace Co., New York.

Graphite

Dixon Crucible Co., Jos., Jersey City, N. J.
Obermayer Co., S., Cincinnati, O.

Grinders, Center

Cincinnati Electrical Tool Co., Cincinnati, O.
Coates Clipper Mfg. Co., Worcester, Mass.
Gem Mfg. Co., Pittsburg, Pa.
Heald Mach. Co., Worcester, Mass.
Hisey-Wolf Mach. Co., Cincinnati, O.
Mueller Machine Tool Co., Cincinnati, O.
Niles-Bement-Pond Co., New York.
U. S. Electrical Tool Co., Cin., O.

Grinders, Cutter

Bath Grinder Co., Fitchburg, Mass.
Becker Milling Mach. Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, O.
Crocker-Wheeler Co., Ampere, N. J.
Garvin Machine Co., New York.
Gould & Eberhardt, Newark, N. J.
Heald Mach. Co., Worcester, Mass.
Hisey-Wolf Mach. Co., Cincin., O.
Ingersoll Milling Mach. Co., Rockford, Ill.
LeBlond Mach. Tool Co., R. K., Cincinnati, Ohio.

Grinders, Cutter—*Continued.*

McCabe, J. J., New York.
Niles-Bement-Pond Co., New York.
Norton Grinding Co., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Rivett Lathe Mfg. Co., Boston, Mass.
U. S. Electrical Tool Co. Cincinnati, O.
Wilmarth & Morman Co., Grand Rapids Mich.

Grinders, Cylindrical

Bath Grinder Co., Fitchburg, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Heald Mach. Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Norton Grinding Co., Worcester, Mass.

Grinders, Disc

Bath Grinder Co., Fitchburg, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Diamond Machine Co., Providence, R. I.
Gardner Machine Co., Beloit, Wis.
Heald Mach. Co., Worcester, Mass.
Ransom Mfg. Co., Oshkosh, Wis.
Safety Emery Wheel Co., Springfield, Ohio.
Taylor & Fenn Co., Hartford, Conn.

Grinders, Drill

Heald Mach. Co., Worcester, Mass.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Niles-Bement-Pond Co., New York.
Safety Emery Wheel Co., Springfield, Ohio.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Standard Tool Co., Cleveland, O.
U. S. Electrical Tool Co., Cincinnati, Ohio
Wilmarth & Morman Co., Grand Rapids, Mich.
Willey Machine Co., Jeffersonville, Ind.

Grinders, Internal

Bath Grinder Co., Fitchburg, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Heald Mach. Co., Worcester, Mass.
Landis Tool Co., Waynesboro, Pa.
Rivett Lathe Mfg. Co., Boston, Mass.
U. S. Electrical Tool Co., Cincinnati, O.

Grinders, Knife

American Wood Working Mchy. Co., Rochester, N. Y.
Defiance Machine Co., Defiance, O.
Safety Emery Wheel Co., Springfield, O.

Grinders, Portable

Cincinnati Electrical Tool Co., Cincinnati, O.
Coates Clipper Mfg. Co., Worcester, Mass.
Hisey-Wolf Mach. Co., Cincinnati, O.
U. S. Electrical Co., Cincinnati, Ohio.

Grinders, Tool

Armstrong Bros. Tool Co., Chicago, Ill.
Barnes Co., W. F. & John, Rockford, Ill.
Bath Grinder Co., Fitchburg, Mass.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Electrical Tool Co., Cincinnati, O.
Cincinnati Milling Machine Co., Cincinnati, O.
Diamond Machine Co., Providence, R. I.
Emmert Mfg. Co., Waynesboro, Pa.
Gisholt Mach. Co., Madison, Wis.
Gould & Eberhardt, Newark, N. J.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Heald Mach. Co., Worcester, Mass.
Hisey-Wolf Mach. Co., Cincin., O
Landis Tool Co., Waynesboro, Pa.
LeBlond Machine Tool Co., R. K., Cincinnati, Ohio.
McCabe, J. J., New York.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Mummert, Wolf & Dixon Co., Hanover, Pa.
Niles-Bement-Pond Co., New York.
Norton Grinding Co., Worcester, Mass.
Ransom Mfg. Co., Oshkosh, Wis.
Rivett Lathe Mfg. Co., Boston, Mass.

Grinders, Tool—*Continued.*

Rockford Drilling Mach. Co., Rockford, Ill.
Safety Emery Wheel Co., Springfield, O.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Standard Tool Co., Cleveland, O.
Tabor Mfg. Co., Phila., Pa.
U. S. Electrical Tool Co., Cincinnati, O.
Vandyck Churchill Co., New York
Vitrified Wheel Co., Westfield, Mass
Whitney Mfg. Co., Hartford, Conn
Wilmarth & Morman Co., Grand Rapids, Mich.

Grinding or Polishing Machines

Abrasive Material Co., Philadelphia, Pa.
American Emery Wheel Co., Providence, R. I.
Barnes Co., W. F. & John, Rockford, Ill.
Bath Grinder Co., Fitchburg, Mass.
Besly & Co., Chas. H., Chicago, Ill.
Blount Co., J. G., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Builders Iron Foundry, Providence, R. I.
Chicago Machine Tool Co., Chicago, Ill.
Cincinnati Electrical Tool Co., Cincinnati, O.
Coates Clipper Mfg. Co., Worcester, Mass.
Crocker-Wheeler Co., Ampere, N. J.
Diamond Machine Co., Providence, R. I.
Gardner Mach. Co., Beloit, Mich.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Heald Machine Co., Worcester, Mass.
Hill, Clarke & Co., Inc., Boston, Mass.
Hisey-Wolf Mach. Co., Cincinnati, O.
Landis Tool Co., Waynesboro, Pa.
Marshall & Huschart Machry. Co., Chicago, Ill.
McCabe, J. J., New York.
Newton Machine Tool Works, Inc., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Northern Electrical Mfg. Co., Madison, Wis.
Norton Grinding Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Ransom Mfg. Co., Oshkosh, Wis.
Roth Bros. & Co., Chicago, Ill.
Safety Emery Wheel Co., Springfield, O.
Stow Mfg. Co., Binghamton, N. Y.
U. S. Electrical Tool Co., Cincinnati, O.
Vandyck Churchill Co., New York.
Vitrified Wheel Co., Westfield, Mass.

Grinding Wheels

Abrasive Material Co., Philadelphia, Pa.
Adams Co., Dubuque, Iowa.
American Emery Wheel Co., Providence, R. I.
Carborundum Co., Niagara Falls, N. Y.
Coates Clipper Mfg. Co., Worcester, Mass.
Diamond Machine Co., Providence, R. I.
Dickinson, Thos. L., New York.
Niles-Bement-Pond Co., New York.
Norton Co., Worcester, Mass.
Safety Emery Wheel Co., Springfield, O.
Vitrified Wheel Co., Westfield, Mass.
Whitney Mfg. Co., Hartford, Conn.

Grindstones and Frames

Cleveland Stone Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Norton Co., Worcester, Mass.

Gun Barrel Machinery

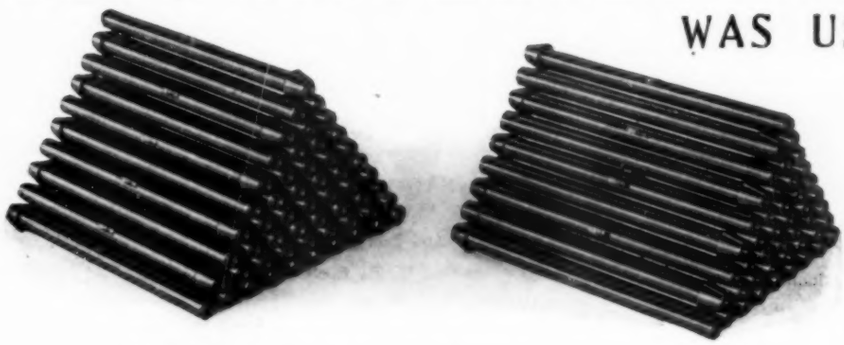
Diamond Machine Co., Providence, R. I.
Pratt & Whitney Co., Hartford, Conn.
Reed Co., F. E., Worcester, Mass.

Hammers, Drop

Bliss Co., E. W., Brooklyn, N. Y.
Bradley & Son, C. C., Syracuse, N. Y.
Chambersburg Engineering Co., Chambersburg Pa
Gould & Eberhardt, Newark, N. J.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Waterbury Farrel Fdry. & Mach. Co., Waterbury, Conn

OUR 10"x30" PLAIN GRINDING MACHINE

WAS USED TO FINISH THESE PINIONS.



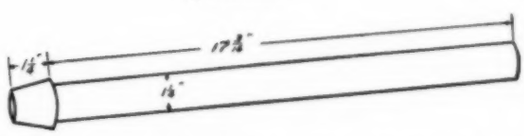
This machine has massive grinding wheel head.

The grinding wheel spindle is hardened and runs in phosphor bronze bearings adjustable for wear.

All levers and hand wheels are within easy reach of the operator.

MACHINERY STEEL

Straight portion ground to .0005 variation limit.
Taper end ground to gauge fit.
1-32" dia. removed from all parts.



AVERAGE TIME 10 MINUTES

Send us samples of your work and we will grind them and furnish information concerning the amount of time consumed in grinding. You can figure the saving yourself.

Let us send you our catalog or circulars.

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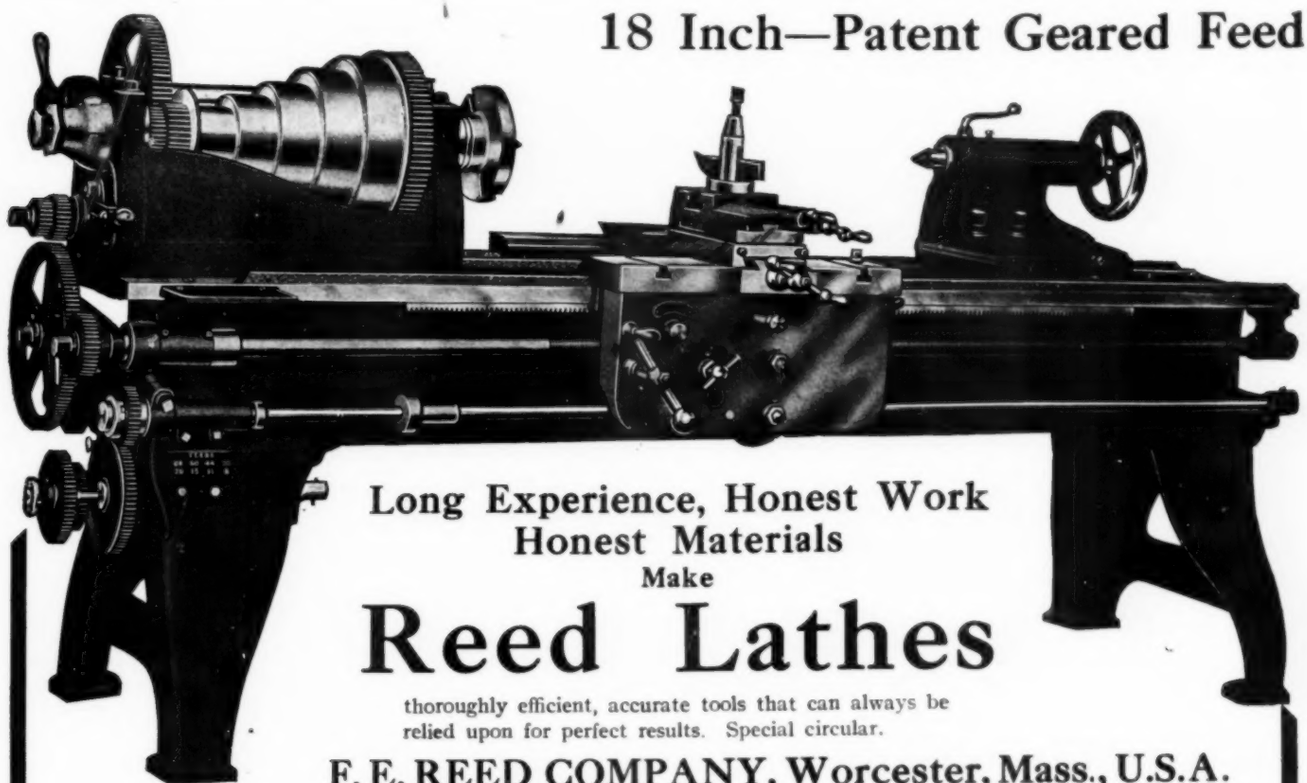
18 Inch—Patent Geared Feed



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Bliss Co., E. W., Brooklyn, N. Y.
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Ingersoll-Rand Co., New York.
Niles-Bement-Pond Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

Hammers, Power

Bradley & Son, C. C., Syracuse, N. Y.
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Prentiss Tool & Supply Co., New York.

Hammers, Steam

Bethlehem Foundry & Machine Co., South Bethlehem, Pa.
Bradley & Son, C. C., Syracuse, N. Y.
Chambersburg Engineering Co., Chambersburg, Pa.
Marshall & Huschart Machinery Co., Chicago, Ill.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Vandyck Churchill Co., New York.

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Manville Mach. Co., E. J., Waterbury, Conn.

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Hoskins Co., The, Chicago, Ill.
Rockwell Furnace Co., New York.

Hobbing Machines, Worm

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Newton Machine Tool Wks., Inc., Phila., Pa.
Pratt & Whitney Co., Hartford, Conn.
Schuchardt & Schutte New York.

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Brown Hoisting Machinery Co., Cleveland, O.
Caldwell & Son Co., H. W., Chicago, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Link-Belt Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Sturtevant Co., B. F., Hyde Park, Mass.
Yale & Towne Mfg. Co., New York.

Hoists, Electric

C & C Electric Co., New York.
Case Mfg. Co., Columbus, O.
Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., New York.
Niles-Bement-Pond Co., New York.
Northern Engineering Works, Detroit, Mich.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
Yale & Towne Mfg. Co., New York.

Hoists, Hand

Case Mfg. Co., Columbus, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Nicholls, Wm. S., New York.
Yale & Towne Mfg. Co., New York.

Hoists, Pneumatic

Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.
Northern Engineering Works, Detroit, Mich.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

Hones

Carborundum Co., Niagara Falls, N. Y.

Hose, Air

Independent Pneumatic Tool Co., Chicago, Ill.

Igniters, Gas Engine

Franklin Mfg. Co., H. H., Syracuse, N. Y.

Indicators, Speed

Warner Instrument Co., Beloit, Wis.

Indicators, Steam Engine

Crosby Steam Gage & Valve Co., Boston, Mass.

Indicators, Test

Grant Mfg. & Mach. Co., Bridgeport, Conn.
Norton Grinding Co., Worcester, Mass.
Starrett Co., L. S., Athol, Mass.

Injectors

Desmond-Stephan Mfg. Co., Urbana, O.
Lunkenheimer Co., Cincinnati, O.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

Inspection and Tests

Hunt Co., Robert W., Chicago, Ill.

Iron Bar

Milton Mfg. Co., Milton, Pa.

Jacks, Hydraulic

Bethlehem Foundry & Machine Co., South Bethlehem, Pa.
Elmes Engineering Works, Chas. F., Chicago, Ill.
Watson-Stillman Co., New York.

Jacks, Planer

Armstrong Bros. Tool Co., Chicago, Ill.

Kettles, Soda

Brown & Sharpe Mfg. Co., Providence, R. I.
Mfg. Equip. & Engineering Co., Boston, Mass.

Key Seaters

Baker Bros., Toledo, O.
Davis Machine Co., W. P., Rochester, N. Y.
Lapointe Mach. Tool Co., Hudson, Mass.
Marshall & Huschart Machry. Co., Chicago, Ill.
McCabe, J. J., New York.
Mitts & Merrill, Saginaw, Mich.
Morton Manufacturing Co., Muskegon Heights, Mich.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Rockford Drilling Mach. Co., Rockford, Ill.
Whitney Mfg. Co., Hartford, Conn.

Keys, Machine

Morse Twist Drill & Mach. Co., New Bedford, Mass.
Standard Gauge Steel Co., Beaver Falls, Pa.
Whitney Mfg. Co., Hartford, Conn.

Knives, Machine

Coes Wrench Co., Worcester, Mass.
Simonds File Co., Fitchburg, Mass.

Lamps, Arc

General Electric Co., New York.
Western Electric Co., Chicago, Ill.
Westinghouse Elec. & Mfg. Co., Pittsburg, Pa.

Lathe Attachments

American Tool Works Co., Cin., O.
Bradford Machine Tool Co., Cincinnati, O.
Fitchburg Machine Works, Fitchburg, Mass.
LeBlond Machine Tool Co., R. K., Cincinnati, Ohio.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Rivett Lathe Mfg. Co., Boston, Mass.
Sebastian Lathe Co., Cincinnati, O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Sloan & Chace Mfg. Co., Newark, N. J.

Lathe Dogs

Armstrong Bros. Tool Co., Chicago, Ill.
Besly & Co., Chas. H., Chicago, Ill.
Hammacher, Schlemmer & Co., New York.

Lathe Dogs—*Continued.*

Pratt & Whitney Co., Hartford, Conn.
Western Tool & Mfg. Co., Springfield, Ohio.

Lathes

American Tool & Machine Co., Boston, Mass.
American Tool Works Co., Cin., O.
Automatic Mach. Co., Bridgeport, Conn.
Barnes Co., W. F. & John, Rockford, Ill.
Blount Co., J. G., Everett, Mass.
Bradford Mach. Tool Co., Cincin., O.
Bridgeford Mach. Tool Works, Rochester, N. Y.
Bullard Mach. Tool Co., Bridgeport, Conn.
Champion Tool Works Co., Cincinnati, O.
Cincinnati Lathe and Tool Co., Cincinnati, O.
Davis Machine Co., W. P., Rochester, N. Y.
Dreses Machine Tool Co., Cin., O.
Fay Mach. Tool Co., Phila., Pa.
Fay & Scott, Dexter, Me.
Fitchburg Machine Works, Fitchburg, Mass.
Garvin Mach. Co., New York.
Gisholt Mach. Co., Madison, Wis.
Greaves, Klusman & Co., Cin., O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Mach. Co., Torrington, Conn.
Hill, Clarke & Co., Inc., Boston, Mass.
LeBlond Mach. Tool Co., R. K., Cincinnati, O.
Lodge & Shipley Mach. Tool Co., Cincinnati, O.
Marshall & Huschart Machry, Co., Chicago, Ill.
McCabe, J. J., New York.
Morris Foundry Co., Jno. B., Cincinnati, O.
Motch & Merryweather Machinery Co., Cleveland, O
New Haven Mfg. Co., New Haven, Conn.
Niles-Bement-Pond Co , New York.
Prentice Bros. Co., Worcester, Mass.
Prentiss Tool & Supply Co., New York.
Reed Co., F. E., Worcester, Mass.
Rockford Drilling Mach. Co., Rockford, Ill.
Schumacher & Boye, Cincinnati, O.
Sebastian Lathe Co., Cincinnati, O.
Sellers & Co., Inc.. Wm., Philadelphia, Pa.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Springfield Mach. Tool Co., Springfield, O.
Toomey, Frank, Philadelphia, Pa.
Vandyck Churchill Co., New York.
Von Wyck Mach. Tool Co., Cincinnati, O.
Walcott & Wood Mach. Tool Co., Jackson, Mich.
Whitcomb-Blaisdell Mach. Tool Co., Worcester, Mass.
Windsor Mach. Co., Windsor, Vt.
Wormer Mchry. Co., C. C., Detroit, Mich.

Lathes, Automatic Screw-Threading

Automatic Machine Co., Bridgeport, Conn.
Fay Machine Tool Co., Phila., Pa.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.

Lathes, Bench

American Watch Tool Co., Waltham, Mass.
Blount Co., J. G., Everett, Mass.
Hardinge Bros., Chicago, Ill.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Sebastian Lathe Co., Cincinnati, O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Stark Tool Co., Waltham, Mass.
Sloan & Chace Mfg. Co., Ltd., Newark, N. J.
Taylor & Fenn Co., Hartford, Conn.
Waltham Machine Works, Waltham, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Lathes, Boring

American Wood Working Machry. Co., Rochester, N. Y.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Phila., Pa.

Lathes, Brass

Bardons & Oliver, Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Springfield Mch. Tool Co., Springfield, O.
Warner & Swasey Co., Cleveland, O

Lathes, Extension

Harrington & Sons Co., Edwin, Philadelphia, P.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.

Lathes, Foot Power

Barnes Co., W. F. & Jno., Rockford, Ill.
Sebastian Lathe Co., Cincinnati, O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Lathes, Gap

American Tool Wks. Co., Cin., O.
Fay & Scott, Dexter, Me.
Harrington & Son Co., Edwin, Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Sebastian Lathe Co., Cincin., O.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

Lathes, Portable

Lodge & Shipley Machine Tool Co., Cincinnati, O.

Lathes, Speed

Blount Co., J. G., Everett, Mass.
Chicago Machine Tool Co., Chicago, Ill.
LeBlond Machine Tool Co., R. K., Cincinnati, O.
Niles-Bement-Pond Co., New York.
Sebastian Lathe Co., Cincin., O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Lathes, Wood

American Wood Working Mchy. Co., Rochester, N. Y.
Barnes Co., W. F. & John, Rockford, Ill.
Defiance Machine Works, Defiance, Ohio.
Fay & Scott, Dexter, Me.
Prentiss Tool & Supply Co., New York.

Levels

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Dixon Crucible Co., Jos., Jersey City, N. J.

Lubricators

Besly & Co., Chas. H., Chicago, Ill.
Gem Mfg. Co., Pittsburg, Pa.

Machinery Dealers

Besly & Co., Chas. H., Chicago, Ill.
Garvin Machine Co., New York.
Hill, Clarke & Co., Inc., Boston, Mass.
Lea Equipment Co., New York.
Manning, Maxwell & Moore, Inc., New York.
Marshall & Huschart Machry. Co., Chicago, Ill.
McCabe, J. J., New York.
Motch & Merryweather Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Pattison Supply Co., W. M., Cleveland, O.
Prentiss Tool & Supply Co., New York.
Schuchardt & Schutte, New York.
Toomey, Frank, Philadelphia, Pa.
Vandyck Churchill Co., New York.
Wormer Mach. Co., C. C., Detroit, Mich.

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Billings & Spencer Co., Hartford, Conn.
Boker & Co., Hermann, New York.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., Cleveland, O.
Hammacher, Schlemmer & Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Schuchardt & Schutte, New York.
Slocomb Co., J. T., Prov., R. I.
Standard Tool Co., Cleveland, O.
Starrett Co., L. S., Athol, Mass.
Whitman & Barnes Mfg. Co., Chicago, Ill.
Williams & Co., J. H., Brooklyn N. Y.

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Besly & Co., Chas. H., Chicago, Ill.
Hammacher, Schlemmer & Co., New York.
McCabe, J. J., New York.
Schuchart & Schutte, New York.
Whitman & Barnes Mfg. Co., Chicago, Ill.

Mandrels, Expanding

Celfor Tool Co., Chicago, Ill.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Nicholson & Co., W. H., Wilkes-Barre, Pa.
Rogers Works, John M., Gloucester City, N. J.

Mandrels, Solid

Morse Twist Drill & Mach Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Rogers Wks., John M., Gloucester City, N. J.
Standard Tool Co., Cleveland, O.

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Slate Machine Co., Dwight, Hartford, Conn.

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Pratt & Whitney Co., Hartford, Conn.
Rogers Works, John M., Gloucester City, N. J.

Mechanical Draft

Sturtevant Co., B. F., Hyde Park, Mass.

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Besly & Co., Chas. H., Chicago, Ill
Clum & Atkinson, Rochester, N. Y.
Lumen Bearing Co., Buffalo, N. Y.
Reeves Pulley Co., Columbus, Ind.

Meters, Cut

Warner Instrument Co., Beloit, Wis.

Micrometer, Calipers

Brown & Sharpe Mfg. Co., Providence, R. I.
Slocomb Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

Milling Attachments

Adams Co., Dubuque, Iowa.
Becker Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, O.
Ingersoll Milling Machine Co., Rockford, Ill.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
LeBlond Machine Tool Co., R. K., Cincinnati, O.
Niles-Bement-Pond Co., New York.
Owen Mach. Tool Co., Springfield, Ohio.
Rivett Lathe Mfg. Co., Boston, Mass.
Whitney Mfg. Co., Hartford, Conn.

Milling Machines, Bench

American Watch Tool Co., Waltham, Mass.
Chicago Machine Tool Co., Chicago, Ill.
Niles-Bement-Pond Co., New York.
Rivett Lathe Mfg. Co., Boston, Mass.
Sloan & Chace Mfg. Co., Ltd., Newark, N. J.

Milling Machines, Bench—*Continued.*

Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Hand

Adams Co., The, Dubuque, Iowa.
Becker Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago Machine Tool Co., Chicago, Ill.
Cincinnati Milling Mach. Co., Cincinnati, O.
Prentiss Tool & Supply Co., New York.
Whitney Mfg. Co., Hartford. Conn.

Milling Machines, Horizontal

Adams Co., The, Dubuque, Iowa.
Beaman & Smith Co., Providence, R. I.
Becker Milling Machine Co., Hyde Park, Mass.
Cincinnati Milling Machine Co., Cincinnati, O.
Hendey Mach. Co., Torrington, Conn.
Hess-Bright Mfg. Co., Philadelphia, Pa.
Ingersoll Milling Mach. Co., Rockford, Ill.
Kempsmith Mfg. Co., Milwaukee, Wis.
Newton Machine Tool Works, Inc., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Plain

Adams Co., Dubuque, Iowa.
American Tool Wks. Co., Cin., O.
Beaman & Smith Co., Prov., R. I.
Becker Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Conn.
Hill, Clarke & Co., Inc., Boston, Mass.
Ingersoll Milling Machine Co., Rockford, Ill.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
LeBlond Mach. Tool Co., R. K., Cincinnati, O.
Marshall & Huschart Machry. Co., Chicago, Ill.
McCabe, J. J., New York.
Morton Manufacturing Co., Muskegon Heights, Mich
Motch & Merryweather Machinery Co., Cleveland, O.
Newton Machine Tool Wks., Inc., Phila., Pa.
Niles-Bement-Pond Co., New York.
Oesterlein Machine Co., Cin., O.
Owen Mach. Tool Co., Springfield, O.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Vandyck Churchill Co., New York.
Waltham Watch Tool Co., Springfield, Mass.
Warner & Swasey Co., Cleveland, O.
Whitney Mfg. Co., Hartford, Conn.
Wormer Mchry. Co., C. C., Detroit, Mich.

Milling Machines, Portable

Newton Mach. Tool Works, Inc., Phila., Pa.
Underwood & Co., H. B., Philadelphia, Pa.

Milling Machines, Universal

American Tool Wks. Co., Cin., O.
Becker Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, O.
Garvin Mach. Co., New York.
Hendey Mach. Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee, Wis.
Kempsmith Mfg. Co., Milwaukee, Wis.
LeBlond Mach. Tool Co., R. K., Cincinnati O

Milling Machines, Universal—*Continued.*

McCabe, J. J., New York.
Marshall & Huschart Machry. Co., Chicago, Ill.
Newton Machine Tool Wks., Inc., Phila., Pa.
Niles-Bement-Pond Co., New York.
Oesterlein Mach. Co., Cincin., O.
Owen Mach. Tool Co., Springfield, Ohio.
Prentiss Tool & Supply Co., New York.
Vandyck Churchill Co., New York.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Vertical

Adams Co., Dubuque, Iowa.
Beaman & Smith Co., Prov., R. I.
Becker Milling Machine Co., Hyde Park, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Garvin Mach. Co., New York.
Hill, Clarke & Co., Inc., Boston, Mass.
Ingersoll Milling Machine Co., Rockford, Ill.
McCabe, J. J., New York.
Newton Mach. Tool Works, Inc., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Owen Mach. Tool Co., Springfield, Ohio.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Vandyck Churchill Co., New York.
Waltham Watch Tool Co., Springfield, Mass.

Milling Machines, Worm

Cleveland Automatic Machine Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.

Milling Tools Adjustable

Geometric Tool Co., New Haven, Conn.
Rogers Works, John M., Gloucester City, N. J.

Mining Machinery

Farrel Fdry. & Mach. Co., Ansonia, Conn.
Ingersoll-Rand Co., New York.

Mixing and Sifting Machines, Sand

Link-Belt Co., Philadelphia, Pa.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

Molding Machines

Adams Co., Dubuque, Iowa.
Tabor Mfg. Co., Philadelphia, Pa.

Molds and Ladles

Goldschmidt Thermit Co., New York.

Mortisers

American Wood Working Machry. Co., Rochester, N. Y.

Motors, Electric

Burke Electric Co., Erie, Pa.
C & C Electric Co., New York.
Coates Clipper Mfg. Co., Worcester, Mass.
Crocker-Wheeler Co., Ampere, N. J.
Cushman Electric Co., Concord, N. H
Eck Dynamo & Motor Co., Belleville, N. J.
Electro Dynamic Co., Bayonne, N. J.
General Electric Co., New York.
Jantz & Leist Elec. Co., Cin., O.
Northern Electrical Mfg. Co., Madison, Wis.
Roth Bros. & Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Mass.
Triumph Elec. Co., Cincinnati, O.
Western Electric Co., Chicago, Ill.
Westinghouse Electric & Mfg. Co., Pittsburg, Pa.

Name Plates

Franklin Mfg. Co., H. H., Syracuse, N. Y.

Nozzles, Sand and Air

Lunkenheimer Co., Cincinnati, O.

Nut Tappers

See Bolt and Nut Machinery.

Oil Cups and Covers

Bay State Stamping Works, Worcester, Mass.
Besly & Co., Chas. H., Chicago, Ill
Lunkenheimer Co., Cincinnati, O.
Winkley Co., Detroit, Mich.

Oils

Besly & Co., Chas. H., Chicago, Ill.

Oilers

American Tube & Stamping Co. Bridgeport, Conn.
Bay State Stamping Co., Worcester, Mass.
Gem Mfg. Co., Pittsburg, Pa.
Winkley Co., Detroit, Mich.

Oxygen Welding

Industrial Oxygen Co., New York
Sanford Mfg. Co., F. C., Bridgeport, Conn.

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Chicago Raw Hide Mfg. Co., Chicago, Ill.
Watson-Stillman Co., New York.

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Felton, Sibley Co., Philadelphia, Pa.

Pans, Lathe

Lyon Metallic Mfg. Co., Aurora, Ill.
New Britain Mach. Co., New Britain, Conn.

Pans, Shop

New Britain Mach. Co., New Britain, Conn.

Patents

Straley & Hasbrouck, New York.

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American Wood Working Machry. Co., Rochester, N. Y.
Baker Bros., Toledo, O.
Blount Co., J. G., Everett, Mass.
Greaves, Klusman & Co., Cin., O.
Defiance Machine Works, Defiance, Ohio.
Hammacher, Schlemmer & Co., New York.
McCabe, J. J., New York
Prentiss Tool & Supply Co., New York.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.
Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass.

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Mummert, Wolf & Dixon Co., Hanover, Pa.

Phosphor Bronze

Lumen Bearing Co., Buffalo, N. Y.

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Sloan & Chace Mfg. Co., Ltd., Newark, N. J.
Stark Tool Co., Waltham, Mass.

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Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Curtis & Curtis Co., Bridgeport, Conn.
Foote-Burt Co., The, Cleveland, Ohio.
Landis Machine Co., Waynesboro, Pa.
McCabe, J. J., New York.
Merrell Mfg. Co., Toledo, O.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
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Standard Engineering Works, Ellwood City, Pa.
Stoever Fdry. & Mfg. Co., Myerstown, Pa.
Vandyck Churchill Co., New York.
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Wrigley Co., Thos., Chicago, Ill.

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Goldschmidt Thermit Co., New York.
Reed Mfg. Co., Erie, Pa.
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Williams & Co., J. H., Brooklyn, N. Y.

Planer Attachments

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Gray Co., G. A., Cincinnati, O.
Reed Co., F. E., Worcester, Mass.

A Machinists' Portable Tool Case

This is the only practical *portable* tool case on the market. The drawers are felt-lined and so arranged that every available inch of space can be used and tools may be kept in perfect order.

The outside measurements of the case are 15⅝" long, 8" deep, 10¾" high, and the weight is 16 pounds. Except the bottom and sides of the drawers it is made of solid, kiln-dried oak, carefully finished, with dovetailed corners and brass trimmings.

Every machinist who has to carry tools from one job to another should have this case.

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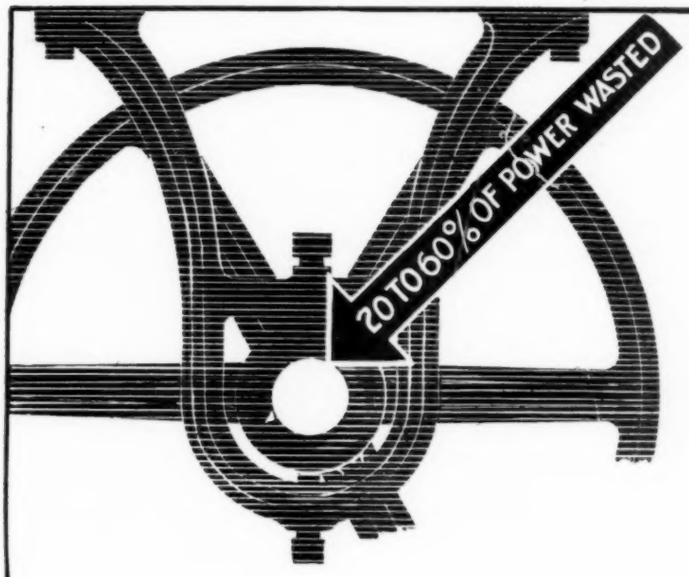

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Cleveland Planer Works, Cleveland, O.
Detrick & Harvey Mach. Co., Baltimore, Md.
Fitchburg Machine Works, Fitchburg, Mass.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Machine Co., New York.
Gray Co., G. A., Cincinnati, O.
Harrington, Son & Co., Edwin, Philadelphia, Pa.
Hendey Machine Co., Torrington, Conn.
Hill, Clarke & Co., Inc., Boston, Mass.
McCabe, J. J., New York.
Motch & Merryweather Machinery Co., Cleveland, O.
New Haven Mfg. Co., New Haven, Conn.
Newton Machine Tool Wks., Inc., Phila., Pa.
Niles-Bement-Pond Co., New York.
Powell Tool Co., Worcester, Mass.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Toomey, Frank, Philadelphia, Pa.
Vandyck Churchill Co., New York.
Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass.
Woodward & Powell Planer Co., Worcester, Mass.
Wormer Mchry. Co., C. C., Detroit, Mich.

Planers, Gear

Gleason Works, Rochester, N. Y.

Planers, Portable

Morton Manufacturing Co., Muskegon Heights, Mich.
Newton Machine Tool Wks., Inc., Phila., Pa.
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Underwood & Co., H. B., Philadelphia, Pa.

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Niles-Bement-Pond Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
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Remington Tool & Mach. Co., Boston, Mass.
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Sloan & Chace Mfg. Co., Ltd., Newark, N. J.
Stark Tool Co., Waltham, Mass.
Waltham Watch Tool Co., Springfield, Mass.

Presses, Broaching

Bliss Co., E. W., Brooklyn, N. Y.
Consolidated Press and Tool Co., Hastings, Mich.
Prentiss Tool & Supply Co., New York.
Watson-Stillman Co., New York.

Presses, Drop

American Tube & Stamping Co., Bridgeport, Conn.
Bliss Co., E. W., Brooklyn, N. Y.
Consolidated Press and Tool Co., Hastings, Mich.
Niles-Bement-Pond Co., New York.

Presses, Foot and Hand

Bliss Co., E. W., Brooklyn, N. Y.
Consolidated Press and Tool Co., Hastings, Mich.
Ferracute Mach. Co., Bridgeton, N. J.
Leonard Mfg. Co., Providence, R. I.
Manville Bros. Co., Waterbury, Conn.
Manville Mach. Co., E. J., Waterbury, Conn.
Taylor & Fenn Co., Hartford, Conn.

Presses, Forging

Bliss Co., E. W., Brooklyn, N. Y.
Consolidated Press and Tool Co., Hastings, Mich.
Niles-Bement-Pond Co., New York.

Presses, Hydraulic

Elmes Engineering Works, Chas. F., Chicago, Ill.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Watson-Stillman Co., New York.

Presses, Power

Automatic Machine Co., Bridgeport, Conn.
Bethlehem Foundry & Machine Co., South Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Consolidated Press and Tool Co., Hastings, Mich.
Dill Slotter People, Philadelphia, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Manville Bros. Co., Waterbury, Conn.
Manville Mach. Co., E. J., Waterbury, Conn.
McCabe, J. J., New York.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Springfield Machine Tool Co., Springfield, O.
Waterbury Farre Fdry. & Mach. Co., Waterbury, Conn.

Presses, Power Forcing

Barnes Co., W. F. & John, Rockford, Ill.
Lucas Machine Tool Co., Cleveland, Ohio.

Presses, Screw

Barnes Co., W. F. & John, Rockford, Ill.
Bliss Co., E. W., Brooklyn, N. Y.
Consolidated Press and Tool Co., Hastings, Mich.

Profilers

American Watch Tool Co., Waltham, Mass.
Becker Milling Machine Co., Hyde Park, Mass.
Garvin Machine Co., New York.
Newton Machine Tool Wks., Inc., Phila., Pa.
Pratt & Whitney Co., Hartford, Conn.

Pulleys

American Pulley Co., Phila., Pa.
American Tool & Machine Co., Boston, Mass.
Caldwell & Son Co., W. H., Chicago, Ill.
Eastern Machinery Co., New Haven, Conn.
Fitchburg Machine Works, Fitchburg, Mass.
McCabe, J. J., New York
New Haven Mfg. Co., New Haven, Conn.
Niles-Bement-Pond Co., New York.
Reeves Pulley Co., Columbus, Ind.
Rockwood Mfg. Co., Indianapolis, Ind.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
Wilmarth & Morman Co., Grand Rapids, Mich.

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Rockwood Mfg. Co., Indianapolis, Ind.

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Harrington, Son & Co. Edwin, Philadelphia, Pa.
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Newton Machine Tool Wks., Inc., Phila., Pa.
Niles-Bement-Pond Co., New York.

Pumps, Electric

General Electric Co., New York.

Pumps, Hydraulic

Elmes Engineering Works, Chas. F., Chicago, Ill.
General Electric Co., New York.
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Pumps, Pneumatic

Ingersoll-Rand Co., New York.

Pumps, Steam

Clayton Air Compressor Works, New York.
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Brown & Sharpe Mfg. Co., Providence, R. I.
Hammacher, Schlemmer & Co., New York
Sellers & Co., Inc., Wm., Phila., Pa.
Starrett Co., L. S., Athol, Mass.

Punches, Hand

Armstrong-Blum Mfg. Co., Chicago, Ill.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

Punches, Hydraulic

Bethlehem Foundry & Machine Co., South Bethlehem, Pa.
Elmes Engineering Works, Chas. F., Chicago, Ill.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc. Wm.: Philadelphia, Pa.
Watson-Stillman Co., New York.

Punches, Power

Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Consolidated Press and Tool Co., Hastings, Mich.
Ferracute Mach. Co., Bridgeton, N. J.
Long & Allstatter Co., Hamilton, Ohio.
McCabe, J. J., New York.
Mitts & Merrill, Saginaw, Mich.
Niles-Bement-Pond Co., New York.
Royersford Foundry & Mach. Co., Royersford, Pa.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Vandyck Churchill Co., New York.

Pyrometers, Electric

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Hoskins Co., The, Chicago, Ill.

Racks, Cut

Boston Gear Works, Norfolk Downs, Mass.
Fellows Gear Shaper Co., Springfield, Vt.
LeBlond Mach. Tool Co., R. K., Cincinnati, O.
Newark Gear Cutting Machine Co., Newark, N. J.
Nuttall Co., R. D., Pittsburg, Pa.
Philadelphia Gear Works, Philadelphia, Pa.
Standard Gauge Steel Co., Beaver Falls, Pa.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
Walcott & Wood Mach. Tool Co., Jackson, Mich.

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Adams Co., Dubuque, Ia.
Fellows Gear Shaper Co., Springfield, Vt.
Gould & Eberhardt, Newark, N. J.
Horsburg & Scott Co., Cleveland, Ohio.
LeBlond Mach. Tool Co., R. K., Cincinnati, O.
Reed Co., F. E., Worcester, Mass.
Schuchardt & Schutte, New York.
Sloan & Chace Mfg. Co., Ltd., Newark, N. J.
Walcott & Wood Mach. Tool Co., Jackson, Mich.

Racks, Tool

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Mfg. Equipment & Engineering Co., Boston, Mass.
New Britain Mach. Co., New Britain, Conn.

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Boker & Co., Hermann, New York.
Card Mfg. Co., S. W., Mansfield, Mass.
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Cleveland Twist Drill Co., Cleveland, O.
Gisholt Mach. Co., Madison, Wis.
Hart Mfg. Co., The, Cleveland, O.
Lapointe Mach. Tool Co., Hudson, Mass.
Morse Twist Drill & Mach. Co., New Bedford, Mass.

Reamers—*Continued.*

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Rogers Works, John M., Gloucester City, N. J.
Smith Co., Wm. J., New Haven Conn.
Standard Tool Co., Cleveland, O.
Ward & Son, Edgar T., Boston Mass.
Whitman & Barnes Mfg. Co., Chicago, Ill.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Reamers, Electric

Van Dorn Elec. Mfg. Co., Cleveland, Ohio.

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Skinner Chuck Co., New Britain, Conn.

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Warner Instrument Co., Beloit, Wis.

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Standard Welding Co., Cleveland, O.

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Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Chambersburg Engineering Co. Chambersburg, Pa.
Niles-Bement-Pond Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Watson-Stillman Co., New York

Riveters, Pneumatic

Bliss Co., E. W., Brooklyn, N. Y.
Independent Pneumatic Tool Co., Chicago, Ill.
Ingersoll-Rand Co., New York.
Niles-Bement-Pond Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.

Riveters, Steam

Chambersburg Engineering Co. Chambersburg Pa.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

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Bethlehem Foundry & Machine Co., South Bethlehem, Pa.
Grant Mfg. & Mach. Co., Bridgeport Conn.
Long & Allstatter Co., Hamilton, Ohio.
Manville Mach. Co., E. J., Waterbury, Conn.
National Machinery Co., Tiffin, O.
Niles-Bement-Pond Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

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Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
Dill Slotter People, Philadelphia, Pa.
Fawcus Mach. Co., Pittsburg, Pa.
Niles-Bement-Pond Co., New York.
Sellers & Co., Inc., Wm. Philadelphia, Pa.
Waterbury Farrel Fdry. & Mach. Co., Waterbury, Conn.

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Slocomb Co., J. T., Prov., R. I.
Starrett Co., L. S., Athol, Mass.

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Huther Bros. Saw Mfg. Co., Rochester, N. Y.
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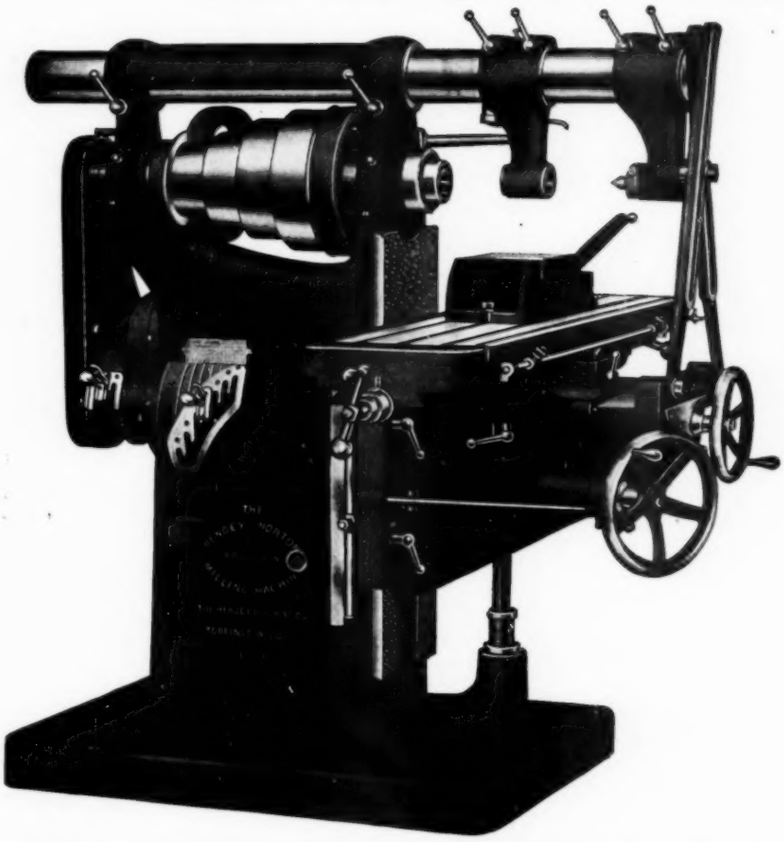

This machine has 21 changes of feeds through gearing and driven by heavy roller chain.

Table, Cross, and Vertical Feeds ALL AUTOMATIC. Ball Bearing Thrusts on elevating and table feed screws.

Each feed has separate engagement, and with feed reverse are within easy control from front of knee.

Table has working surface of 48.5" x 13", and 3 T slots ⅝" wide. Range of feeds 34" x 10" x 20".

Main Spindle has Taper Journals at either end, running in Annular Bearings, fitted with Ring Oilers. The best spindle construction used as it affords longest possible wear and maintains accuracy of alignment.

Top Housings for Arm are ANNULAR and fitted with self-centering Binders.

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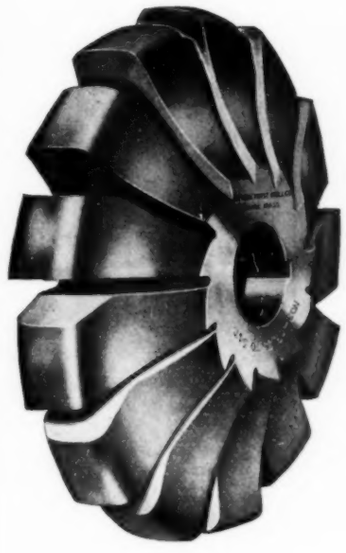

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It is unwise to take the chance of using gear cutters which may not be properly shaped. Such a cutter is not only unsatisfactory in itself but liable to cause an actual loss, as it is sometimes necessary to reject gears which do not run properly.

We are able to present a line of GEAR CUTTERS, which, owing to our very full knowledge of the details, makes it possible for you to place the utmost confidence in the fact that your service will be improved and that the standard of your gears as to accuracy of shape of teeth and smoothness of running will be of the highest.

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Gorton Machine Co., Racine, Wis.
Lea Equipment Co., New York.
Newton Machine Tool Works, Inc., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Tabor Mfg. Co., Philadelphia, Pa.
Union Twist Drill Co., Athol, Mass.
Vandyck Churchill Co., New York.
West Haven Mfg. Co., New Haven, Conn.

Sawing Machines, Wood
American Wood Working Mchry. Co., Rochester, N. Y.
Colburn Mach. Tool Co., Franklin, Pa.
Greaves, Klusman & Co., Cin., O.
Seneca Falls Mfg. Co., Seneca Falls, N. Y.

Saws, Metal Band
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
West Haven Mfg. Co., New Haven, Conn.

Saws, Power Hack
Diamond Saw & Stamping Works, Buffalo, N. Y.
Hoefer Mfg. Co., Freeport, Ill.
Niles-Bement-Pond Co., New York.
West Haven Mfg. Co., New Haven, Conn.

Saws, Screw Slotting
Simonds File Co., Fitchburg, Mass.

Saw Sharpening Machines
Newton Machine Tool Wks., Inc., Phila., Pa.

Schools, Correspondence
American School of Correspondence, Chicago, Ill.
International Correspondence Schools, Scranton, Pa.

Screw Driving Machines
Reynolds Mach. Co., Rock Island, Ill.

Screw Machines, Automatic
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland, O.
Dreses Mach. Tool Co., Cincin., O.
Marshall & Huschart Machinery Co., Chicago, Ill.
National-Acme Mfg. Co., Cleveland, O.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Universal Machine Screw Co., Hartford, Conn.
Windsor Mach. Co., Windsor, Vt.
Wood Turret Mach. Co., Terre Haute, Ind.

Screw Machines, Hand
Bardons & Oliver, Cleveland, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Mach. Co., Cleveland, O.
Garvin Machine Co., New York.
Grant Mfg. & Mach. Co., Bridgeport, Conn.
Jones & Lamson Mach. Co., Springfield, Vt.
Pratt & Whitney Co., Hartford, Conn.
Rivett Lathe Mfg. Co., Boston, Mass.
Warner & Swasey Co., Cleveland, O.
Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass.
Windsor Mach. Co., Windsor, Vt.
Wood Turret Mach. Co., Terre Haute, Ind.

Screw Machinery, Wood and Lag
Baker Bros., Toledo, O.
Cook Co., Asa S., Hartford, Conn.

Screw Plates
Besly & Co., Chas. H., Chicago, Ill.
Brubaker & Bros., W. L., Millersburg, Pa.
Butterfield & Co., Derby Line, Vt.
Card Mfg. Co., S. W., Mansfield, Mass.
Carpenter Tap & Die Co., J. M., Pawtucket, R. I.
Hart Mfg. Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Wiley & Russell Mfg. Co., Greenfield, Mass.

Screws, Cap and Set
Hammacher, Schlemmer & Co., New York.
National-Acme Mfg. Co., Cleveland, O.
Worcester Machine Screw Co., Worcester, Mass.

Screws, Machine
Bay State Screw Co., Springfield, Mass.
Hammacher, Schlemmer & Co., New York.
National-Acme Mfg. Co., Cleveland, O.
Screw Machine Products Corp., Providence, R. I.
Standard Gauge Steel Co., Beaver Falls, Pa.
Universal Machine Screw Co., Hartford, Conn.
Worcester Machine Screw Co., Worcester, Mass

Second Hand Machinery
American Tool Works Co., Cin., O.
Davis Machine Co., W. P., Rochester, N. Y.
Garvin Machine Co., New York.
Hill, Clarke & Co., Inc., Boston, Mass.
Marshall & Huschart Machinery Co., Chicago, Ill.
McCabe, J. J., New York.
Motch & Merryweather Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Pattison Supply Co., W. M., Cleveland, Ohio.
Prentiss Tool & Supply Co., New York.
Toomey, Frank, Philadelphia, Pa.
Wormer Machry. Co., C. C., Detroit, Mich.

Separators, Oil and Steam
American Tool & Machine Co., Boston, Mass.
Nicholson & Co., W. H., Wilkes-Barre, Pa.

Shapers
American Tool Works Co., Cin., O.
Cincinnati Shaper Co., Cincinnati, O.
Davis Machine Co., W. P., Rochester, N. Y.
Fitchburg Machine Works, Fitchburg, Mass.
Flather Planer Co., Mark, Nashua, N. H.
Garvin Machine Co., New York.
Gould & Eberhardt, Newark, N. J.
Hendey Machine Co., Torrington, Conn.
Hill, Clarke & Co., Inc., Boston, Mass.
Juengst & Sons, Geo., Croton Falls, N. Y.
Kelly Mach. Co., R. A., Xenia, O.
Marshall & Huschart Machinery Co., Chicago, Ill.
McCabe, J. J., New York.
Morton Manufacturing Co., Muskegon Heights, Mich.
Newton Machine Tool Wks., Inc., Phila., Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Hartford, Conn.
Prentiss Tool & Supply Co., New York.
Q. C. Machine Tool Co., Cincinnati, O.
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Smith & Mills, Cincinnati, O.
Springfield Machine Tool Co. Springfield, O.
Vandyck Churchill Co., New York.
Walcott & Wood Machine Tool Co., Jackson, Mich.

Shapers, Wood
American Wood Working Machry. Co., Rochester, Pa.

Shears, Hand
Armstrong-Blum Mfg. Co., Chicago, Ill.

Shears, Power
Bethlehem Foundry & Machine Co., South Bethlehem, Pa.
Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa
Bliss Co., E. W., Brooklyn, N. Y.
Ferracute Mach. Co., Bridgeton, N. J.
Long & Allstatter Co., Hamilton, O.
Mitts & Merrill, Saginaw, Mich.
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Royersford Foundry & Mach. Co., Royersford, Pa
Sellers & Co., Inc., Wm., Philadelphia, Pa.
Vandyck Churchill Co., New York.
Whitcomb-Blaisdell Machine Tool Co., Worcester, Mass

Shears, Rotary
Bethlehem Foundry & Machine Co., South Bethlehem, Pa.
Bliss Co., E. W., Brooklyn, N. Y.
Consolidated Press and Tool Co., Hastings, Mich.

Sheet Metal Working Machines
Bliss Co., E. W., Brooklyn N. Y.
Consolidated Press and Tool Co., Hastings, Mich.
Ferracute Machine Co., Bridgeton, N. J.

Slide Rests
American Watch Tool Co., Waltham, Mass.
Betts Mach. Co., Wilmington, Del.
Blount Co., J. G., Everett, Mass.
Garvin Machine Co., New York.
National Acme Mfg. Co., Cleveland, O.
Newton Mach. Tool Works, Inc., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Reed Co., F. E., Worcester, Mass.

Slotters
Baker Bros., Toledo, O.
Betts Mach. Co., Wilmington, Del.
Dill Slotter People, Philadelphia, Pa.
Garvin Machine Co., New York.
McCabe, J. J., New York.
National-Acme Mfg. Co., Cleveland, O.
New Haven Mfg. Co., New Haven, Conn.
Newton Machine Tool Works, Inc., Philadelphia, Pa
Niles-Bement-Pond Co., New York.
Prentiss Tool & Supply Co., New York.
Sellers & Co., Inc., Wm., Philadelphia, Pa.

Slotters, Auto Screw
Manville Mach. Co., E. J., Waterbury, Conn.
Taylor & Fenn Co., Hartford, Conn.

Slotters, Portable
Newton Machine Tool Wks., Inc., Phila., Pa.

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American Specialty Co., Chicago, Ill.
Celfor Tool Co., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, O.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Standard Tool Co., Cleveland, O.
Union Twist Drill Co., Athol, Mass.

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Birdsboro Steel Fdry. & Mach. Co., Birdsboro, Pa.
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Boston Tool Co., Cambridge, Mass.
Consolidated Press and Tool Co., Hastings, Mich.
Dorman, John H., New York.
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Harrison & Knight Mfg. Co., Newark, N. J.
Hilbert Mach. Co., Cincinnati, Ohio.
Hoefer Mfg. Co., Freeport, Ill.
Lucas Mach. Tool Co., Cleveland, Ohio.
Merritt, Jos., Hartford, Conn.
Morrow Mfg. Co., Elmira, N. Y.
Mueller Mach. Tool Co., Cin., O.
Owen Mach. Tool Co., Springfield, Ohio.
Pratt & Whitney Co., Hartford, Conn.
Q. C. Machine Tool Co., Cincinnati, O.
Schaeffer Machine Wks., Philadelphia, Pa.
Sloan & Chace Mfg. Co., Ltd., Newark, N. J.
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Standard Engineering Works, Ellwood City, Pa.
Taylor & Fenn Co., Hartford, Conn.
Turner Mach. Co., Danbury, Conn.

Spring Winders
Remington Tool & Mach. Co., Boston, Mass.

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Dunbar Bros. Co., Bristol, Conn.

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Link-Belt Co., Philadelphia, Pa.
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Woburn Gear Works, Woburn, Mass.

Stampings, Sheet Metal
American Tube & Stamping Co Bridgeport, Conn.
Bay State Stamping Co., Worcester, Mass.

Stampings, Welded
Standard Welding Co., Cleveland, Ohio.

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Eastern Machinery Co., New Haven, Conn.
Hoggson & Pettis Mfg. Co., New Haven, Conn.
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Steel Machinery
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Cammell, Laird & Co., New York.
Firth-Sterling Steel Co., McKeesport, Pa.
Standard Gauge Steel Co., Beaver Falls, Pa.
Ward & Son, Edgar T., Boston, Mass.

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American Tube & Stamping Co., Bridgeport, Conn.
Firth-Sterling Steel Co., McKeesport, Pa.
Simonds File Co., Fitchburg, Mass.
Ward & Son, Edgar T., Boston, Mass.

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Boker & Co., Hermann New York.
Cammell, Laird & Co., New York.
Firth-Sterling Steel Co., McKeesport, Pa
Standard Gauge Steel Co., Beaver Falls, Pa.
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Stocks, Die
See Taps and Dies.

Stones, Oil
American Emery Wheel Co., Providence, R. I
Carborundum Co., Niagara Falls, N. Y.
Norton Co., Worcester, Mass.
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Errington, F. A., New York.
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Hardinge Bros., Chicago, Ill.
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Nicholson & Co., W. H., Wilkes-Barre, Pa.
Pratt & Whitney Co., Hartford, Conn.
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Ward & Sons, Edgar T., Boston, Mass.
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Taps, Collapsing

Geometric Tool Co., New Haven, Conn.

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Rivett Lathe Mfg. Co., Boston, Mass.
Rogers Works, John M., Gloucester City, N. J.

Thread Rolling Machinery

Manville Mach. Co., E. J., Waterbury, Conn.

Tool Holders

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Hammacher, Schlemmer & Co., New York.
Krieger Tool Mfg. Co., Chicago, Ill.
L. K. Tool Holder Co., Shelton, Conn.
Pratt & Whitney Co., Hartford, Conn.

Tools, Small

See Machinists' Small Tools.

Transformers and Converters

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General Electric Co., New York.
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Sellers & Co., Inc., Wm., Philadelphia, Pa.

Trolleys and Tramways

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Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
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Almond Mfg. Co., T. R., Ashburnham, Mass.
American Tube & Stamping Co., Bridgeport, Conn.

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American Tube & Stamping Co., Bridgeport, Conn.
Standard Welding Co., Cleveland, O.
Ward & Son, Edgar T., Boston, Mass.

Turntables

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Bardons & Oliver, Cleveland, O.
Bradford Mach. Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Mach. Tool Co., Bridgeport, Conn
Davis Machine Co., W. P., Rochester, N. Y.
Dreses Mach. Tool Co., Cin., O.
Fay Mach. Tool Co., Phila., Pa.
Garvin Mach. Co., New York.
Gisholt Mach. Co., Madison, Wis.
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LeBlond Mach. Tool Co., R. K., Cincinnati, O.
Marshall & Huschart Machinery Co., Chicago, Ill.
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Wood Turret Mach. Co., Terre Haute, Ind.

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Standard Tool Co., Cleveland, O.
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American Tool Wks. Co., Cin., O.
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Vises, Universal Machine

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Vises, Wood Workers

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Parker Co., Chas., Meriden, Conn.
Pratt & Whitney Co., Hartford, Conn.

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New Britain Machine Co., New Britain, Conn.

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Bristol Co., Waterbury, Conn

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Milton Mfg. Co., Milton, Pa.

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Prentiss Tool & Supply Co., New York.
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Bemis & Call Hardware & Tool Co., Springfield, Mass.
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Whitman & Barnes Mfg. Co., Chicago, Ill.
Williams & Co., J. H., Brooklyn, N. Y.

Wrenches, Ratchet

Parker Co., Chas., Meriden, Conn.
Pratt & Whitney Co., Hartford, Conn.

Wrenches, Tap

Besly & Co., Chas. H., Chicago, Ill.
Card Mfg. Co., S. W., Mansfield, Mass.
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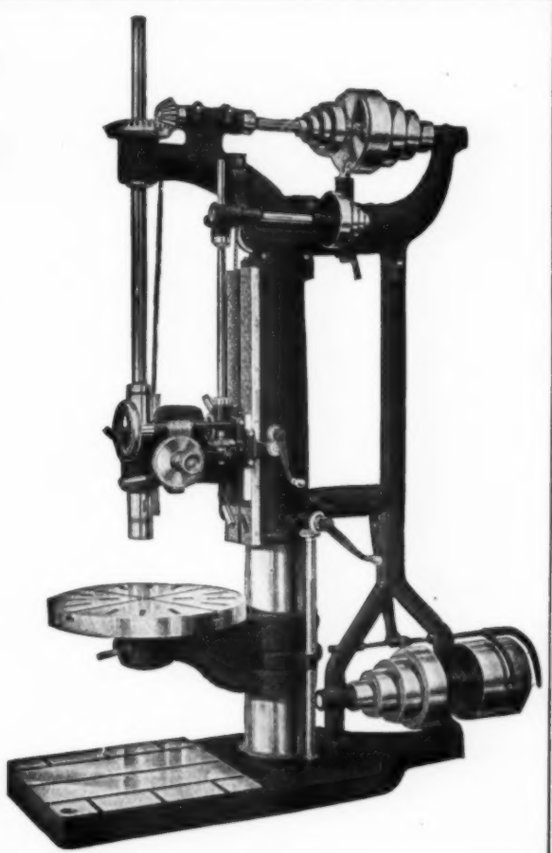

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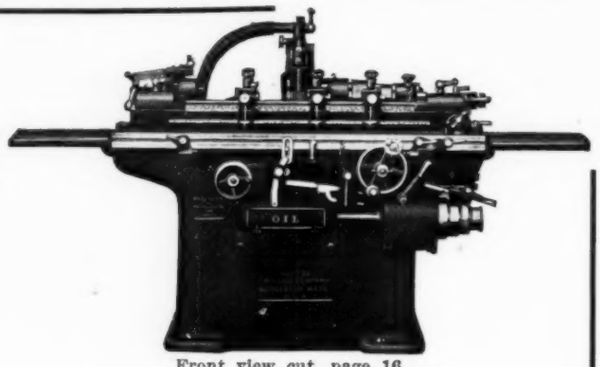

Front view cut, page 16
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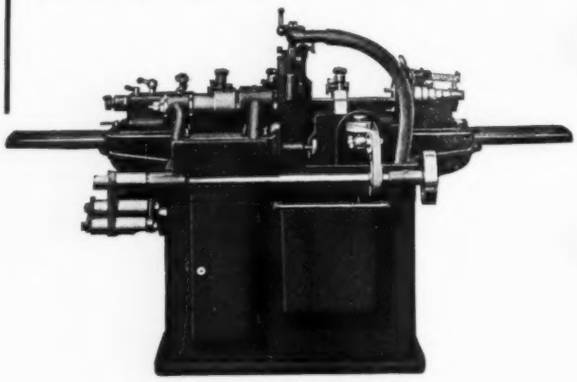
On a Norton 6″ x 32″ Plain Grinding Machine



Rear view cut, page 16,
1907 Catalog, N 7

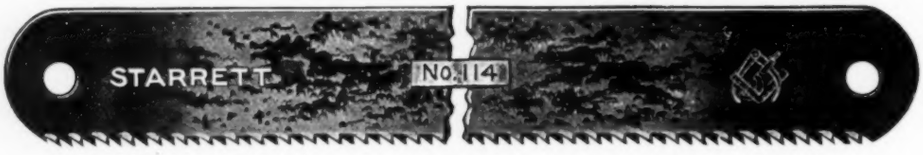
Piston Pins ¾″ diameter, 4″ long, 60 per hour to a limit of .0005″ is only one example. Let us show you some others. Send for Catalog N-7.

NORTON GRINDING COMPANY

Worcester, Mass., U. S. A.

Chicago Store, 48 So. Canal Street

Ludw. Loewe & Co., Ltd., London, Berlin, European Agents
F. W. Horne, Yokohoma, Japan. 74 N



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you can be sure of finding the quality that means longest life, quickest, keenest cutting power and complete satisfaction.

CATALOG NO. 17 C. IS THE ONE TO ASK FOR:

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Norton Grinding Wheels are made of Alundum.

Grinding Wheel Logic

GRINDING is simply a "cutting" process for removing metal. The hard, sharp abrasive particles projecting from the working face of the wheel are the tools that do the cutting, each particle cutting its own minute chip from the work. These little tools (abrasive grains) get dull and, to keep the wheel cutting they must fracture or break away from the bond that holds them together at just the right time, thus making way for new cutting points. Efficiency of a grinding wheel, therefore, is dependent to a large extent upon the combination of temper and hardness of the abrasive.

Alundum possesses the ideal combination of temper and hardness, which is secured and constantly maintained through the purity of raw material used and perfect control of the Electric Furnace Process.

Alundum is used in the manufacture of Norton Grinding Wheels because we know it has the right qualities.

Norton Company

Grinding Wheel Works, Worcester, Mass.

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F—43

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wanted by large machine tool building company. None but the highest class man will be considered.

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Write for our NEW CATALOG "B."

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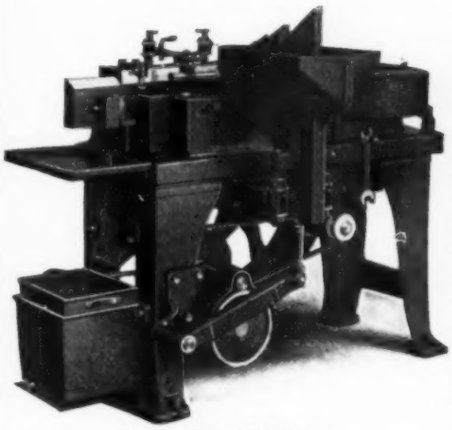
New Britain, Conn.

Thread Rolling Machines

Hand or Automatic Feeds



No. 3. Thread Roller, having removable Auto. Feed

This does not mean that "PERHAPS," they will operate automatically but they are so perfected that they *will* and do a good day's work without being constantly "poked" to keep them going, and that is certainly a novelty in *this* line.

You may learn a lot from our Catalog D-10.

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Waterbury, Conn., U. S. A.

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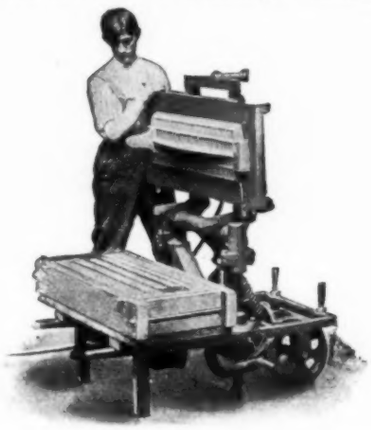

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Tabor Hinged Molding Machines

offer a positive solution to the problem of "how to reduce the cost of castings?" They are so constructed as to turn out castings too large for the ordinary power machine to handle, and are rapid and accurate in their operation.

Then consider their portability. They save time and countless trips to and fro carrying sand and molds. For the sake of a marked saving in cold, hard cash write us for a catalog.

The Tabor Manufacturing Co.,

Mfrs. of High Duty Cold Saws.

18th and Hamilton Sts., Philadelphia, Pa.

THE STRONGEST HIGH SPEED TWIST DRILL MADE IS THE "NORKA"

Because it is twisted while hot, therefore the grain of the steel is not disturbed.

There are no tangs to twist off and no turning in the socket.

We can demonstrate to you that the "Norka" is the most economical High Speed Drill made. Write us for Catalog No. 67 and prices.

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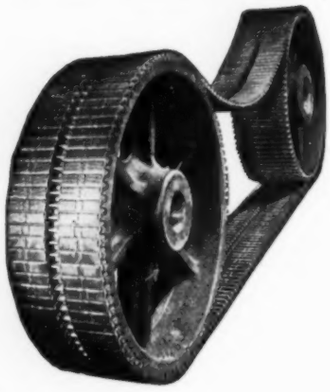

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Does all a gear or belt can do and does it better without noise or slip.

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Morse Chain Company

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Licensees for Great Britain and Europe: The Westinghouse Brake Co., Ltd , 32 York Road, Kings Cross, London, N.

"Seneca Falls" Speed and Wood-Turning Lathes

Are made by the same workmen and with the same care as our celebrated "Star" Screw-Cutting Engine Lathes.

Reliable, self-oiling, dust proof, phosphor-bronze bearings, hollow spindle of forged crucible steel. Tailstock with combination screw and lever feeds. Locking levers attached and always in place. Bed is unusually strong and rigid; thoroughly braced by cross webs. Countershaft has self-oiling and self aligning shaft bearings. Can furnish with draw-in chucks, and split collets for rod work, also oil-pan, foot power, etc.

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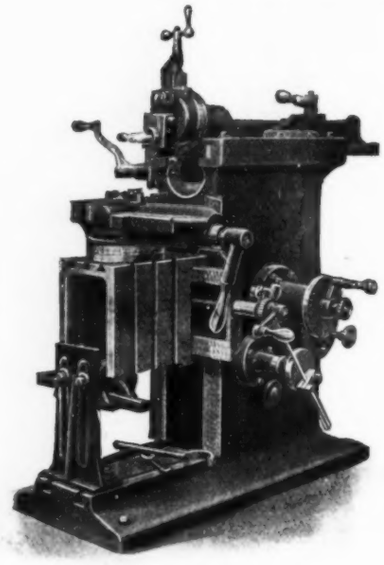

16", 21" and 26" Crank Shaper

Prices on Application

Geo. Juengst & Son,

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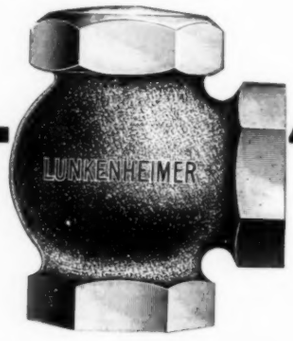

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Are designed for the most severe service and are guaranteed to give perfect satisfaction.

Always Tight. Will Not Stick. No Pounding.

We also manufacture horizontal, angle, and swing iron body check valves.

YOUR LOCAL DEALER SHOULD HAVE THEM, IF NOT NOTIFY US.

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FARWELL

Quick Change Miller

Key Seater,
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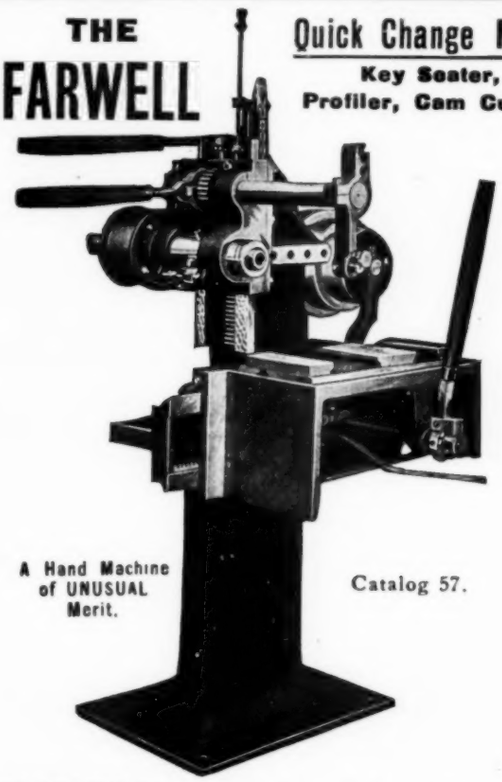

A Hand Machine of UNUSUAL Merit.

Catalog 57.

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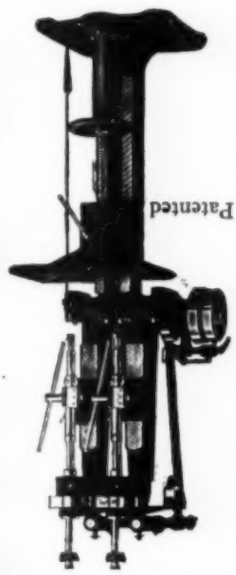
have been drilled on our Ball-Bearing Drilling Machines by the largest and most successful concerns in the world.

Thousands of Dollars Extra Profit

has been made by these concerns who are able to do 200 to 400% more work in a given time than formerly.



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CATALOG?

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A stock of our machines is carried on hand at all times by the following agents: Hill, Clarke & Co., New York, Boston, Chicago, St. Louis; W. M. Pattison Supply Co., Cleveland; E. A. Kinsey Co., Cincinnati; J. W. Wright & Co., St. Louis. We are also represented by the Chas. G. Smith Co., Pittsburg; W. E. Shipley, Philadelphia; Cotton States Belting and Supply Co., Atlanta; Roy Machinery Co., Minneapolis; Bailey-Smith Machinery Co., San Francisco.

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As Stanch As Man Knows

You'll get a new start now—better times. Begin them with necessary sundries which will carry you through success or slump and keep your name constantly before buyers and users. Get the best there is. Every Wm's Line guaranteed for allotted purposes.

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STAND in just as high favor as the Jacks. They are made in a range that is well nigh infinite.

Presses that are noted for lasting efficiency under exacting service.

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Quality Of Output Justifies Cost

Eberhardt's Patent Double Triple Quick Stroke "High Duty" Shaper

The very fact that our Shapers cost a little more than others, makes them the cheapest to own—because they possess the quality that means strength, lasting accuracy and convenience, features that cannot be had for nothing. The quality that costs, brings results that pay.

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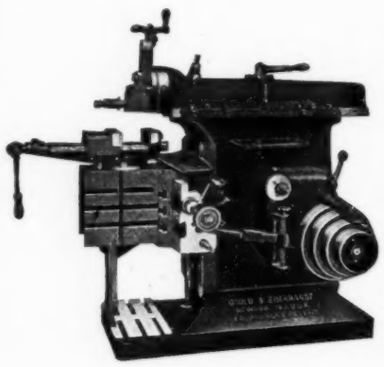

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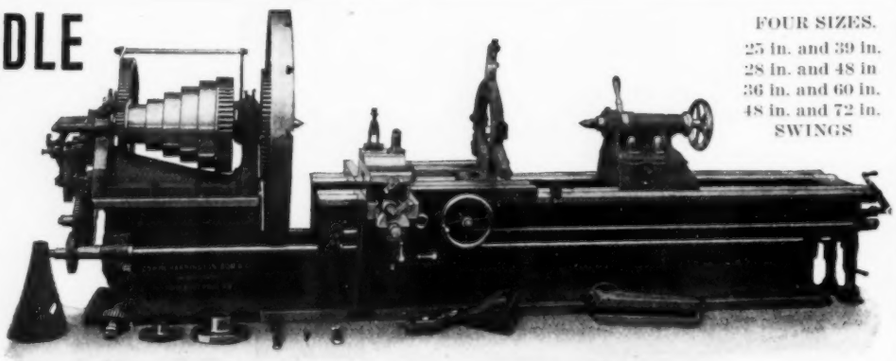
"HIGH DUTY" SHAPERS
AUTOMATIC GEAR AND RACK CUTTING MACHINERY
ESTABLISHED 1833 NEWARK, N.J. U.S.A.

YOU CAN HANDLE ALL THE WORK

that comes your way—big and little—provided you turn it on Harrington's Extension Gap Lathe. No need to "turn down" jobs. The gap can be adjusted to suit 'em so that you can "turn 'em out."

Write for a new money making method of handling jobbing and repair work.



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25 in. and 39 in.
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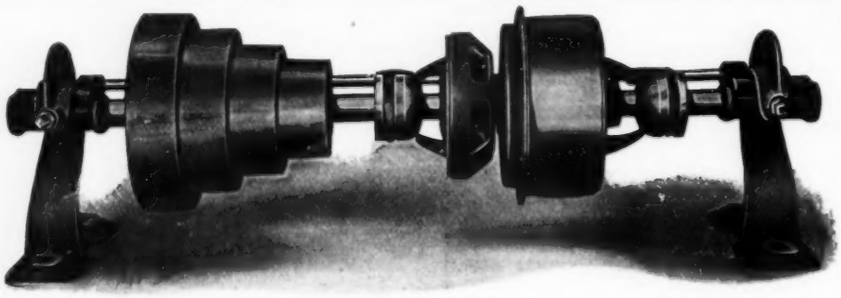

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Two-Speed One-Belt Countershaft, One Forward and One Reverse.
Ask your dealer for the Smith One-Belt Reversing Countershaft. It is the Best, most Durable, Efficient and Economical on the Market.

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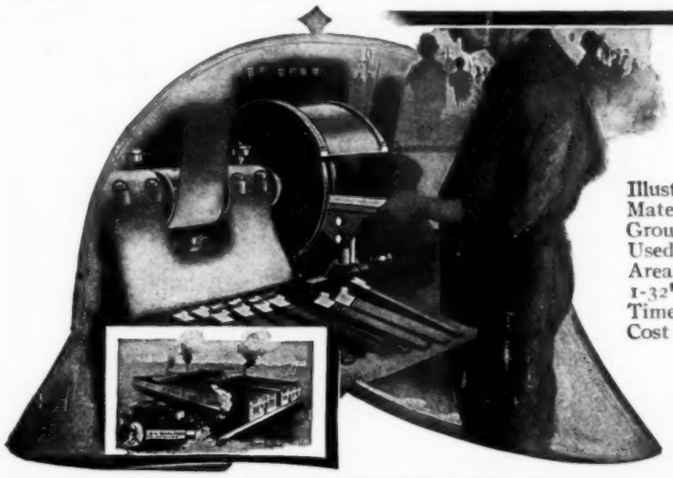

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Let us show you what we can do for you.

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Area of ground surface—2½ square inches on each side.
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are but two of many points of superiority.

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— FOR —
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The "Johnson" saves money from the very first. Gets every ounce of good out of the power and doesn't waste it. Is neat, small, compact and wonderfully powerful. Operates without vibration and has only about one-half the number of parts that other clutches are hindered with. The heavier the pull—the better the "Johnson" proves its superiority.

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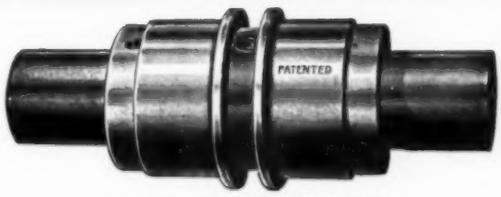

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In the mixing, firing and grading of AMERICAN wheels, in fact, in every department of our works, we employ the most modern methods of manufacture. The result is that AMERICAN EMERY WHEELS AND CORUNDUM WHEELS represent the highest possible efficiency and economy.

Don't be grinding with "old-fashioned" wheels. Would you like to have an AMERICAN wheel sent you on trial with the understanding that if it is not more efficient than any you have ever used there will be no charge to you?

AMERICAN EMERY WHEEL WORKS, PROVIDENCE, R.I. U. S. A.

As they have little or no tendency to heat tools the most satisfactory wheels today are

VITRIFIED WHEELS
(MADE of CORUNDUM)

Manufacturers of high speed steels recommend them for best grinding results on high speed steel tools. Catalog?

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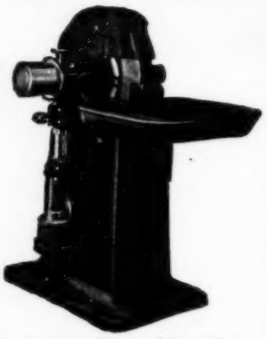
DON'T DROWN YOUR WHEEL

Too much water is just as bad as too little.

The Blount Wet Tool Grinder pumps water to the wheel only when running, the supply is exactly proportioned to the speed and can be regulated to suit your needs.



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Designed and built by F. N. Gardner, well known as the inventor and originator of Disc Grinders. Send for Catalogue and record of "Actual Tests."

Gardner Machine Co, Beloit, Wis.
The Disc Grinding Authorities.

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Motor Driven Grinders. Wet Grinders
Belt " " Disc "
Ransom Patent Speed Controllers.

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with a New Yankee Drill Grinder. 'Tis practically impossible to do this with any other machine but ours. Only *two* adjustments are needed. We guarantee to accurately *finish* a drill in less time than any other machine can be gotten ready to grind on. Saves drills, time and money. Catalog?

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Requisites of

Satisfactory Grinding

in a nut shell are—adaptability of the grinding wheel to each particular material to be ground.

To select the exact grade and grain of wheel necessary for best results, requires long years of experience—we have it.

To manufacture perfect wheels of uniform bond and cutting qualities throughout, requires the best of facilities—we have them.

We guarantee satisfaction, so don't trifle with a wheel not suited to your work.

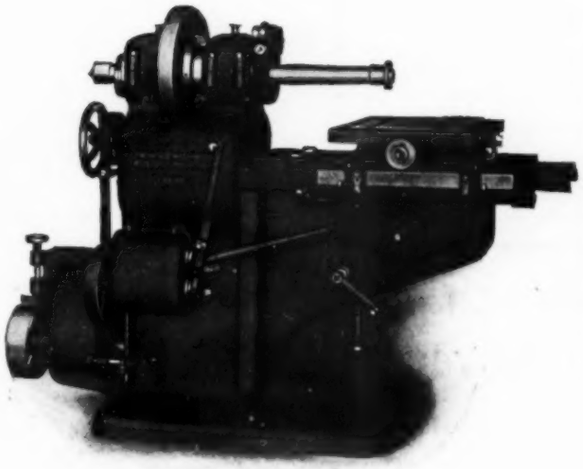
The Safety Emery Wheel Co., Springfield, Ohio.

Rapid, Accurate, Internal Grinding Is Easily Done On The Heald Cylinder Grinder

This machine, from bottom to top, was built to do special work in a special way. It was designed for the internal grinding of machine parts and is peculiarly adapted to finishing holes in castings of such size or shape that they cannot be handled in the usual method. It furnishes the *quickest, best, most accurate* and *most economical* method of doing such work. The cross-slide table makes it possible to grind two or more holes in one casting, at accurate distances apart and with a guarantee of correct alignment—*at a single setting.* This makes it a valuable machine for finishing cylinders of gas or gasoline engines.

It is a simple and easy machine to operate. With it the average workman can turn out a large amount of high-grade work, quickly and cheaply.

Grinds holes 3″ to 9″ in diameter by 15″ or 18″ long.



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For Vise Quality—Get Parker's

Parker's Hold-Fast Combination Pipe Vises are equally useful and economical to the Piper and the Machinist. They grip securely, are powerful, durable. Jaws are solid. Bar and Collar one piece.

Renewable Jaws.

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Precision Bench Lathes.
Bench Milling Machines.
Automatic Wheel and Pinion Cutting Machinery.
Sub-press Compound Punches and Dies.
Upright Rack and Pinion Gauges.
AMERICAN WATCH TOOL COMPANY,
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Because it's the best vise that can be had at *any* price. Because you are protected—first, by our rigid tests, and second, by our guarantee against breakage. Stationary or Swivel Base. Catalog "K."

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DRILL VISE Universal Jig
DRILL SPEEDERS,
THE GRAHAM MFG. CO., Providence, R.I.

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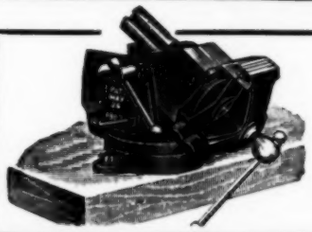
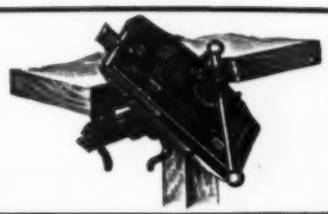
because they are tried, true, convenient and compact. *Write.* We make all sorts of good vises—been at it twenty years. Catalog and price list is free.

Fulton Machine & Vise Co.,
Lowville, N. Y., U. S. A.



A NEW VISE
NOTHING TOO IRREGULAR FOR THESE JAWS TO HOLD
FURNISHED WITH FIVE PAIRS OF HOLDING JAWS TO DO ALL KINDS OF WORK IN ANY POSITION
CATALOGUE FREE
Emmert Manufacturing Co.
WAYNESBORO, PA.



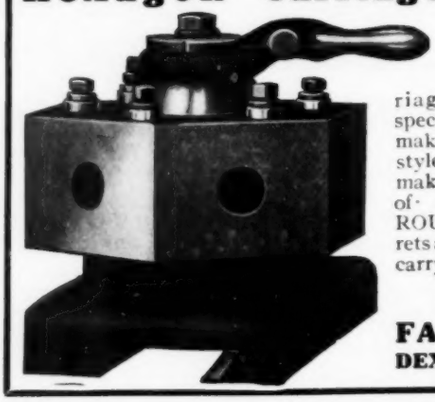
Special Machines Or Parts Built To Order

We are prepared to do all kinds of general machine work at moderate prices—high grade work guaranteed. Let us estimate on your duplicate parts, cam cutting, etc.

Write us.

The Fuller Manufacturing Company,
New Haven, Conn.

Hexagon Carriage Turret

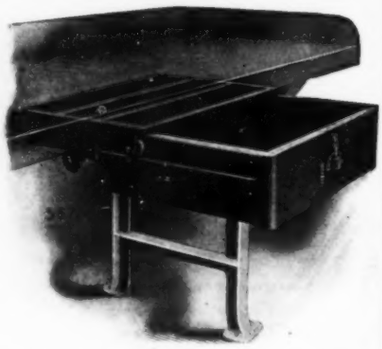


A device which soon pays its initial cost. Carriage turrets are a specialty with us. We make them in several styles to fit on any make lathe in place of the tool block. ROUND Carriage Turrets and other styles for carrying various tools.

Circular?

FAY & SCOTT,
DEXTER, MAINE.

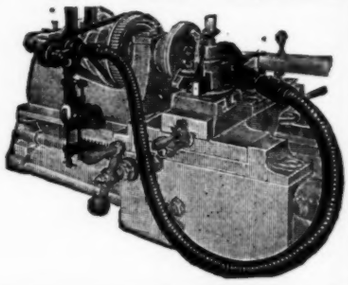
Bench Drawers



Our drawers are made with wooden back, bottom and front to protect tools. They give full exposure and have metal frames, roller bearing and cannot bind. *Write for full details.*

THE NEW BRITAIN MACHINE CO., NEW BRITAIN, CONN.

Center Grinding On Any Lathe Without Other Power Than The Power Of The Lathe Pulley.



Write For Bulletin No. 20.

Coates Clipper Mfg. Co.,
Worcester, Mass.

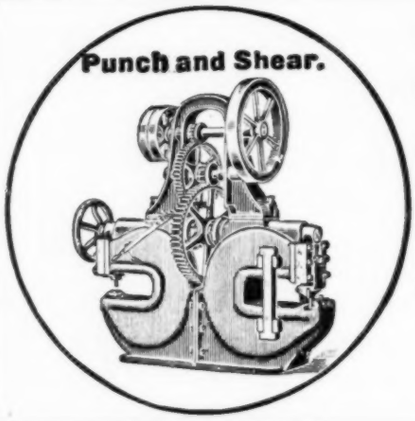
New Model Turret Lathes Bardons & Oliver

Made in 4″x30″ and also 4½″ and 6″ sizes with belt drive or direct connected motor for all kinds of difficult forming work. Strong, heavy, rigid and powerful. We also make a full line of tools for these lathes.

Send for full particulars

BARDONS & OLIVER, CLEVELAND, O.

Punch and Shear.

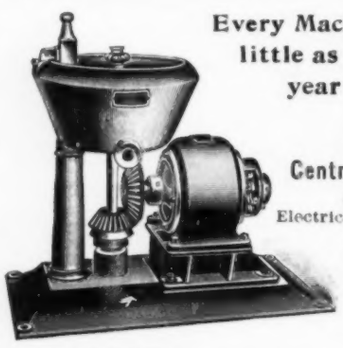


Bethlehem Foundry & Machine Co.,

Rotary Shears, Universal Benders, Cap Riveters.

Write for Catalog.

South Bethlehem, Pa.



Every Machine Shop using as little as 3 barrels of oil a year will find the

ROPER
Centrifugal Oil Separator

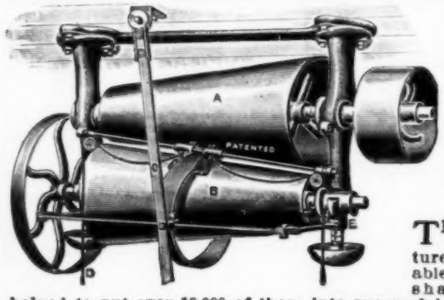
A great money saver
Electrically Driven Motor Wound For Any Voltage

Separates oil from bolts, nuts, and scraps of all kinds—oil that would otherwise be wasted, and makes it as good as it ever was for further use.

Send for full information.

Founded 1845 Incorporated 1864

AMERICAN TOOL & MACHINE CO. Boston, Mass.



Novelty Simplicity and General Utility

THOSE are three prominent features of Evans Variable Speed Countershafts that have helped to put over 10,000 of them into successful use. They are noiseless, powerful and positive in action and they furnish any speed from 1 to 6 by simply pulling a cord. Made for floor or hanging use. Catalog 25.

Evans Friction Cone Co., 1288 Center St., **Newton Center, Mass.**
A. Warden & Co., London, E. C., England.

Your Factory Is Never Worth What It Costs You

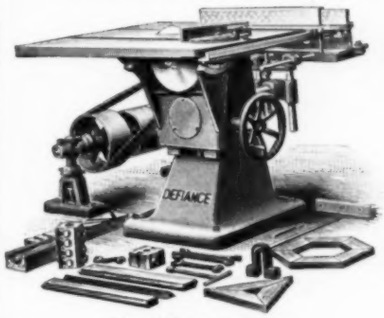
Why invest your capital in a plant that costs a lot of money and takes a long time to develop when we are ready to build your machines promptly on contract?

We can get the cost of production to the lowest point and you can use your capital for building up business instead of machines.

Let us figure on your blue prints.

Blanchard Machine Co., The Contract Shop. **Cambridge, Mass.**

"DEFIANCE" WOOD-WORKING MACHINERY



No. 8 Variety Saw

for **Pattern Shops** and **General Wood Work**

Invented and Built by

The Defiance Machine Works

DEFIANCE, OHIO

CLEANING and GRINDING CASTINGS

with a Gem Flexible Shaft Outfit has become the common shop practice of all first class shops.

Particulars?

GEM MANUFACTURING CO.
3257 Spruce Street,
Pittsburg, Pa., U. S. A.

English Agents—A. A. Jones, Pollard & Shipman Co., Ltd., Churchgate, Leicester, England.

KEY-SEATER FEATURES THE GIANT

has a grooved post for holding work and guiding tool that insures perfect accuracy, it is quickly adjustable for different sizes of work; finishes two key-seats before one piece can be fastened ready for key-seating on other styles.

Catalog "M" tells more.

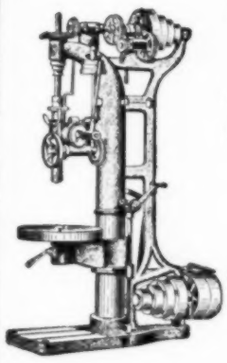
MITTS & MERRILL
913 Tilden St.,
SAGINAW, - MICH.

Foreign Agents: C. W. Burton, Griffiths & Co., London, England. Heinrich Dreyer, Berlin, Germany and Austria. J. E. Chabert & Co., 64 Ave. de la Republique, Paris, France.

You Can Make Your Own Name and Direction Plates

and handle your difficult engraved die work with this Engraving Machine of ours and save a lot of money and time. This is a thing worth looking into. May we send a catalog?

Geo. Gorton Machine Co., Racine, Wis.



WE MAKE NOTHING BUT DRILLS

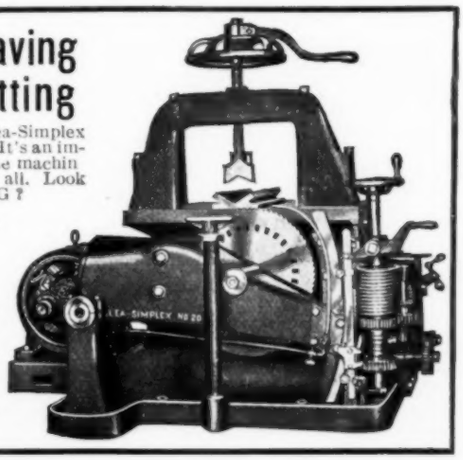
Sizes twenty to thirty-two inches, equipped with motors, gear or belt driven.

Sibley Machine Tool Co.
South Tutt Street,
South Bend, Ind., U. S. A.

Money-Saving Metal Cutting

is done by the Lea-Simplex Cold Metal Saw. It's an improved up-to-date machine that excells them all. Look it up. CATALOG?

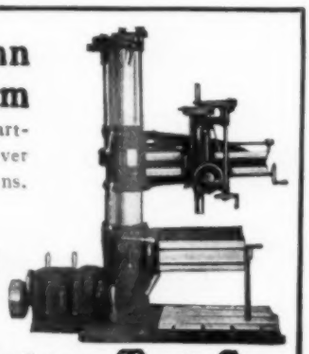
Cut shows No. 20 Motor Driven.



LEA EQUIPMENT COMPANY,
136 Liberty St.,
NEW YORK.

Stationary Column and Revolving Arm

Sixteen Speeds, seven feeds. Starting, stopping and reversing lever in easy reach from all positions. Booklet on request.

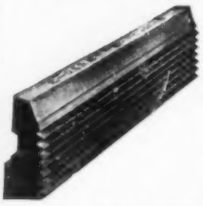


Mueller Patented Radial Drill

The Mueller Machine Tool Co.
Cincinnati, Ohio, U. S. A.

The

LANDIS Patent Bolt Cutter



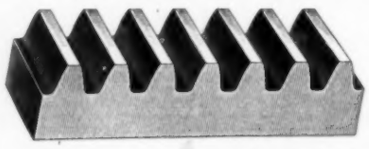
Economical because of the Landis die which lasts longer than other dies. Lasts longer because it can be renewed indefinitely by re-grinding. There are many other features described in our bulletin. Send for it.

Landis Machine Co., Waynesboro, Pa., U. S. A.

Schuchardt & Schutte, 34 Victoria St., Westminster, London, Sole Agents for Great Britain, Ireland, British Colonies. Schuchardt & Schutte, 9 Kiangse Road, Shanghai, Sole Agents for China and Japan. Adler & Eisenschitz, Milan, Sole Agents for Italy.

Get Your Machine Rack Ready Made

We are equipped with special machinery and every facility for making accurate tooth machine rack.



Any length up to 25 feet, in one section, from any size blank and in 3, 4, 5, 6, 7, 8, 10 and 12 diametral pitch.

It won't cost you anything to send your specifications and get our quotation, and it will probably be the means of saving you money.

Standard Gauge Steel Company,

Beaver Falls, Pa., U. S. A.

Hall & Pickles, 64 Port Street, - - Manchester, England.

A-1 Files

are the "AMERICAN SWISS"

FILES — TRADE ONLY THE BEST ARE GOOD ENOUGH MARK — TOOLS

"Better than Imported Swiss?" TRY THEM—Our salesmen are sample packages of "American Swiss" files—sent on request to any responsible manufacturer.

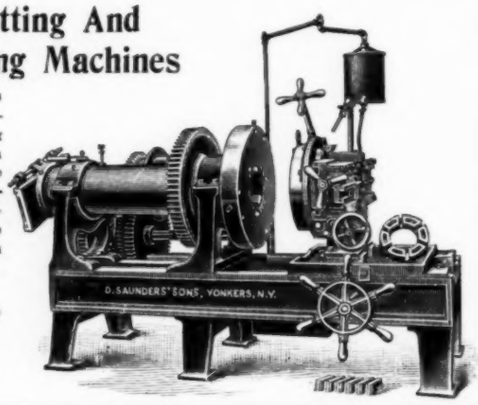
E. P. REICHHELM & CO., 24 John St., N.Y.

Pipe Cutting And Threading Machines

This No. 6 has patent adjustable expanding die-head, with interchangeable chasers. Obtains nearly uniform surface speed for each size of pipe.

DETAILS?

D. Saunders' Sons, Yonkers, N. Y.



EVERY successful manufacturer puts first things first. In buying drill presses you want efficiency and durability.

We have gained efficiency by the manner in which we have placed our operating levers and power feed.

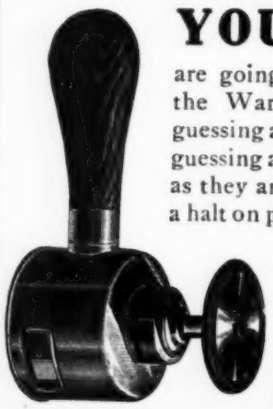
Durability has come through careful attention to the minor details of construction such as grinding and proper materials.

Let us send you our latest catalog, "M," just off the press

Hœfer Mf'g. Co.

FREEPORT, - ILLINOIS, - U. S. A.

For Great Britain, C. W. Burton Griffiths Company, London; for Sweden, Axel Christiernsson, of Stockholm, Malmo and Gutenberg; for Finland, Axel Christiernsson, Abo; for Switzerland, J. Lambercier & Cie, Geneva; for France, Mestre & Blatge, Paris and Tunis; for Spain, Mestre & Blatge, Madrid; for Austria, Blau & Company, Vienna; for Victoria, Australia, Bevans & Edwards Propty Ltd., Melbourne; for New South Wales, Australia, R. S. Scrutton, Sydney; or Queensland, McLennan & Co., Brisbane.



YOUR PROFITS

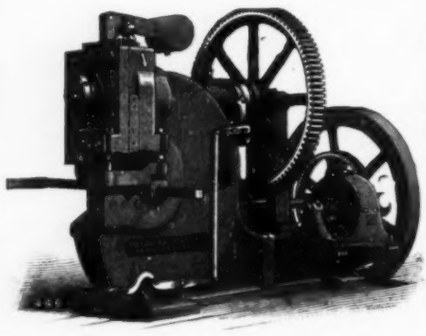
are going to the bad—unless you use the Warner Cut Meter. If you're guessing at the speed of your tools you're guessing a speed about four times as fast as they are actually running. Better call a halt on profit-killing—speed your tools up to their economical limit—make more money—in short, use the Cut Meter.

There's a Catalog waiting for you—want it?

Warner Instrument Co.,

51-59 Roosevelt Ave., Beloit, Wis.

The Long and Allstatter Company



Design and Manufacture

Power Punches and Shears

for Bars, Plates, Angles, Beams and Special Shapes, Riveting Machines, Tire Welding Machines, Drop and Helve Hammers, Armature Disc Notching Machines, etc., etc.

Address

Hamilton, Ohio, U. S. A.

D X N D X N D X N D X N

IT goes directly to the cause of friction, microscopic roughness, and provides the friction surfaces with a tough, smooth, durable coating that reduces friction and saves wear. That's what Dixon's Flake Graphite does—use it with oil or grease.

Write for our new little booklet "Flake No. 4"

JOSEPH DIXON CRUCIBLE CO., JERSEY CITY, N. J.

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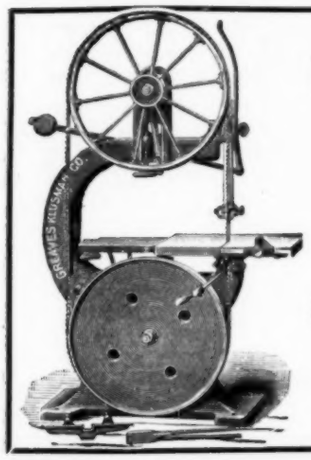


Pattern Shop Machinery

GREAVES, KLUSMAN & CO.,

N. E. Cor. Cook and Alfred Sts.

CINCINNATI, OHIO.

Use "Spiral Fluted" Reamers

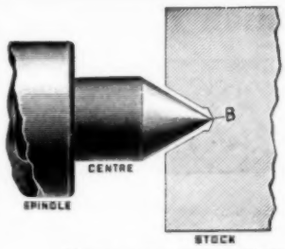
The best form of Flute

for all purposes. Give them a trial.

Catalog 33 B and prices sent on application.

Wiley & Russell Mfg. Co.,

Greenfield, Mass., U. S. A.



A BAD CENTER

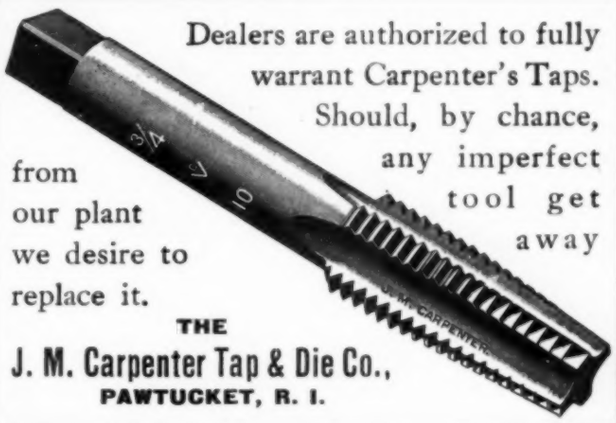
like this is detrimental to good work. It simply CANNOT give the proper clearance for point of lathe center.

If you use the SLOCOMB COMBINATION DRILL you can drill upwards of 3,000 centers, each one having correct angles and perfect clearance.

Get a Catalog.

J. T. SLOCOMB COMPANY, Providence, Rhode Island, U. S. A.

Chas. Churchill & Co., London, Birmingham, Manchester and Glasgow. Ludw. Loewe & Co., Berlin, for Continental Europe. Thos. McPherson & Son, Melbourne, Australia.



Dealers are authorized to fully warrant Carpenter's Taps. Should, by chance, any imperfect tool get away from our plant we desire to replace it.

THE

J. M. Carpenter Tap & Die Co.,

PAWTUCKET, R. I.

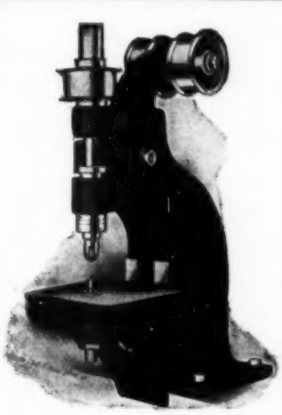
1 min. 59 sec. Saved out of every 2 minutes

That being the difference, in working time, between the hand hammer and the Grant Riveting Machine. There is a proportional difference in the quality of the result. Booklet?

GRANT MFG. & MACH. CO.

Bridgeport, Conn.

AGENTS—Strong, Carlisle & Hammond Co., Cleveland, Ohio, and Detroit, Mich. McDowell Stocker & Co., Chicago, Ill. Charles Churchill & Co., 9 Leonard St., London, E. C. England. John McDonald & Son, Ltd., 5 and 9 York St., Glasgow, Scotland. Schuchardt & Schutte, Austria, Hungary, and the Balkan States.



WOODWARD & POWELL PLANERS

are strong and rigid enough to prevent all jar and chatter. The gearing is powerful and smooth-running. Wide range, speed, exactness and ease of operation are strong points. *Catalog 9*

WOODWARD & POWELL PLANER CO.

WORCESTER, MASS., U. S. A.

AGENTS—Manning, Maxwel. & Moore, New York City, Philadelphia, Chicago, Ill., Seattle, Wash., Portland, Oregon, Pittsburg, Pa., Cleveland, Ohio, Boston, Mass., Birmingham, Ala., Mexico City, Mexico, Tokio, Japan. Canton & Hong Kong, China. Hewshaw, Bulkley & Co., San Francisco and Los Angeles, Cal. Fenwick, Freres & Co., Paris, France. Herman Haelbig, Germany and Austria.

SWAGING

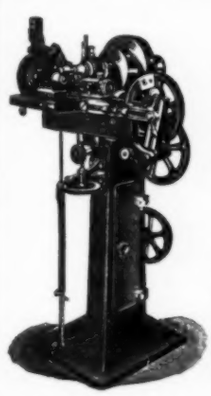
can be done faster and more economically with the Dayton Swaging Machine than by any other method. It works by pressure instead of blows—improves the metal, and turns out accurate work.

BOOK?

EXCELSIOR NEEDLE CO.

TORRINGTON, CONN.

Coventry Swaging Co., Ltd., White Friars Lane, Coventry, England, Agents for Great Britain. Fenwick Freres & Co., 8 Rue de Rocroy, Paris, France. Agents for France, Italy, Belgium, Spain, Portugal and Switzerland.



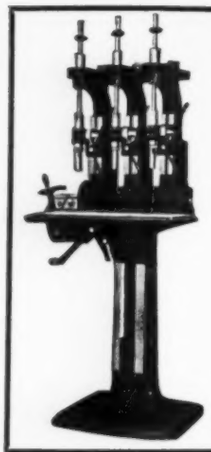
We Use Our Own Automatic Gear Cutters

to cut the gears we use. Just have to. Never saw any machine to equal ours for accuracy, convenience in operation and cheapness in gear cutting.

Many other manufacturers use these machines for the same reason. You will, too, just as soon as you realize some facts in Catalog 26-G. Write for a copy today.

Dwight Slate Machine Co.,

Hartford, Conn., U. S. A.



A Powerful Drill

Our "Manufacturer's Drill" has remarkable power and a positive drive with but *one* belt. It has a wide range, is easy of adjustment and meets almost all drilling requirements.

Write for Guarantee and Details.

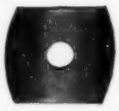
One to Six Spindles

The Taylor & Fenn Co.,
Hartford, Conn.

Builders of Drilling Machines, Disk Grinders, Foot Presses, Bench Lathes, and Automatic Screw Slotting Machines.

E. Sonnenthal, Jr., Berlin, Cologne and Vienna.

SPRING WASHERS

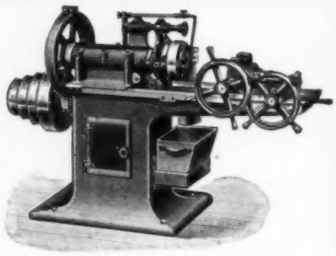


Hardened and tempered washers—flat, cupped and with flanged sides from $\frac{3}{16}$" diameter, .010 thick, to 3" diameter, .125 thick.

Let us estimate on some of your work of this character. Write for Bulletin, showing some of our various styles.

The Wallace Barnes Co.
Bristol, Conn.

Acme Bolt Cutters

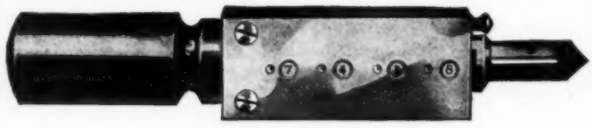


are fitted with the well-known Acme die head, which has a special adjustment for adjusting the dies to size without stopping the machine. The dies are all made interchangeable with the steel caps; dies changed from one size to another in less than one minute. Acme Die Heads are all lined with tool steel hardened and ground to size. Write for Catalog "M."

The Acme Machinery Co., Cleveland, O., U.S.A.

Foreign Agents—C. W. Burton, Griffiths & Co., London, England. Schuchardt & Schutte, Berlin, Vienna, Stockholm and St. Petersburg. A. H. Schutte, Cologne, Brussels, Liege, Paris, Bilbao, Barcelona and Milan.

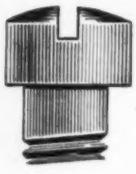
"Initiative" Revolution Counters



The old confusing way of reading the count on a dial is replaced by the simplicity of "Initiative" Counters. They register from 0 to 10,000 in either direction and are easily set to zero from any number. The count is read like an ordinary number.

SCHUCHARDT & SCHÜTTE
136 Liberty St., New York.

Rivet And Nut Machinery



We build time, money and labor saving machinery for making all kinds of Rivets, Bolts, Nuts, Etc. Machinery for Rolling Threads; also machinery for making Hammers and Presses of all kinds. Kindly mention "American Machinist" when writing for catalog.

The Waterbury Farrel Foundry & Machine Co.
Waterbury, Conn.
Western Office, Cleveland, O., 1312 Williamson Bldg.

Shapers

Having 8 cutting speeds, T-Slots cut from solid metal, cut gears throughout table support part of machine.

GET FULL DETAILS

THE R. A. KELLY CO.,
MAKERS OF MACHINERY
P. O. Box 488. Xenia, Ohio., U. S. A.

DUXBAK BELTING
TRADE MARK

What Are Your Belting Needs?

If you will write us, outlining them, we'll send you a belting that will meet your needs satisfactorily. THERE'S NO COST TO YOU unless you are satisfied.

Chas. A. Schieren Company
ESTABLISHED 1864

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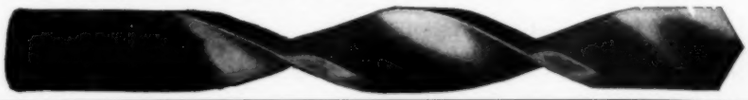

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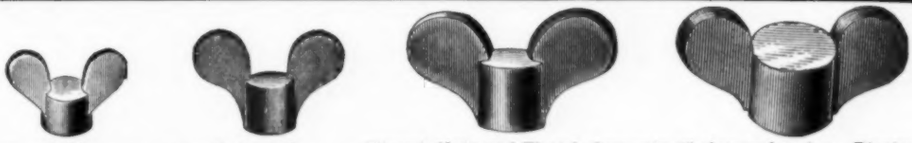

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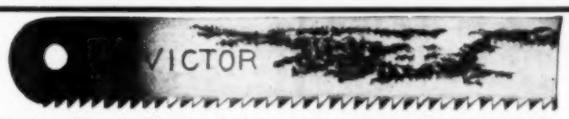

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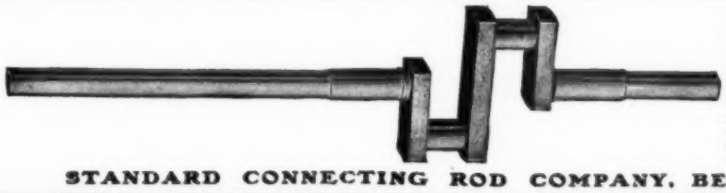

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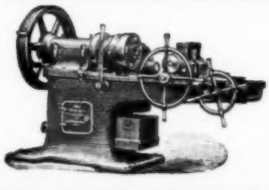

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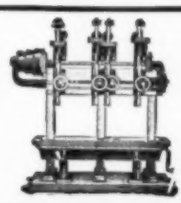

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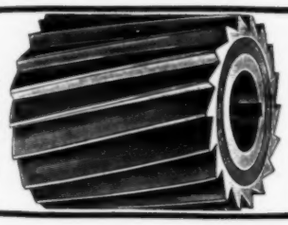

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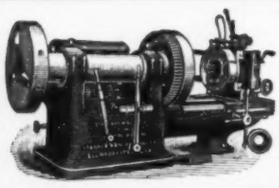

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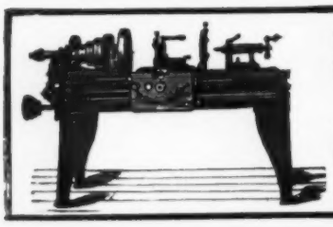

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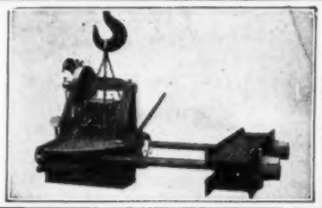

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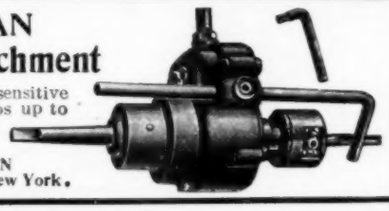

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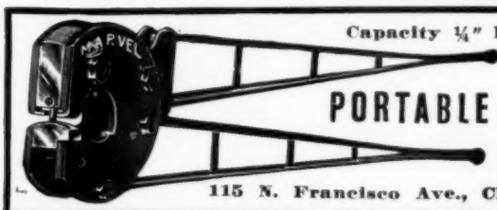

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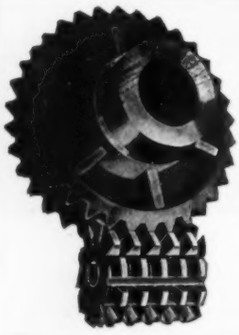

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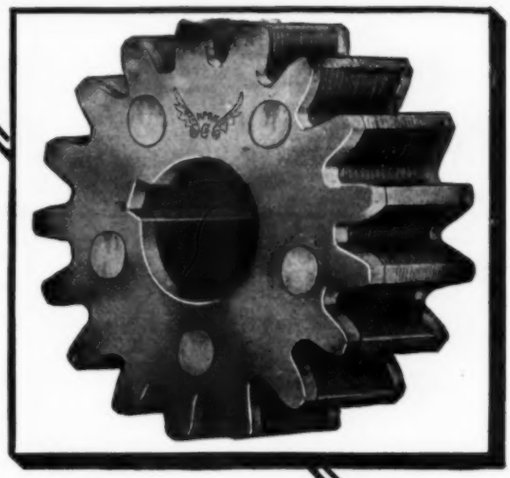

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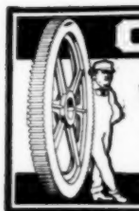

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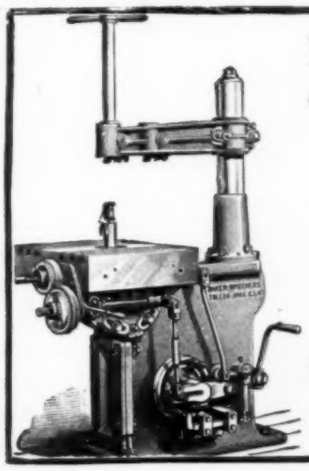

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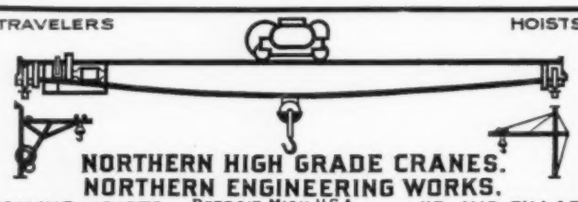

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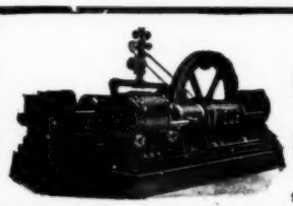

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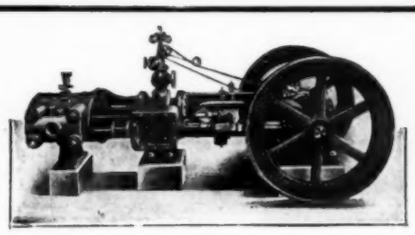

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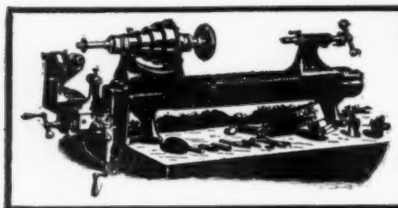

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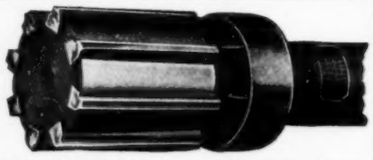

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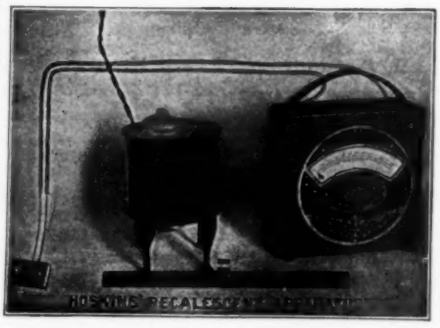

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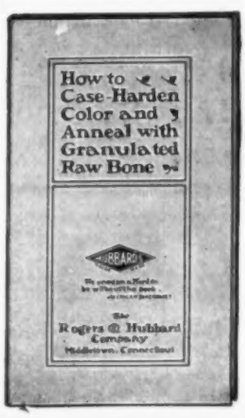

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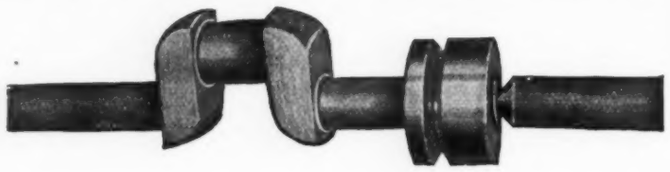

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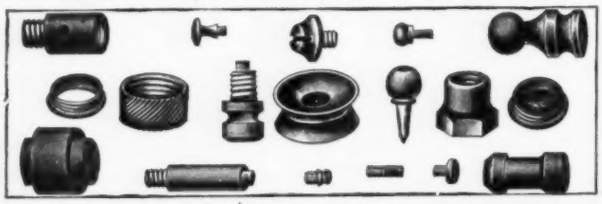

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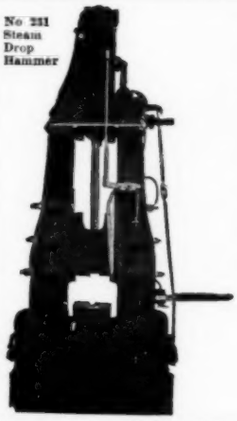
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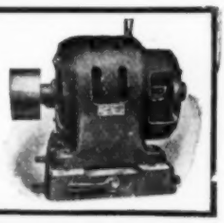

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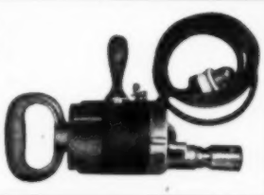

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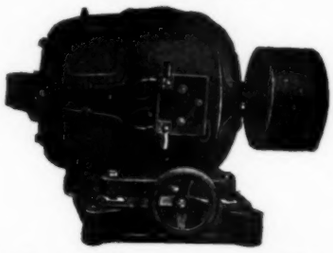

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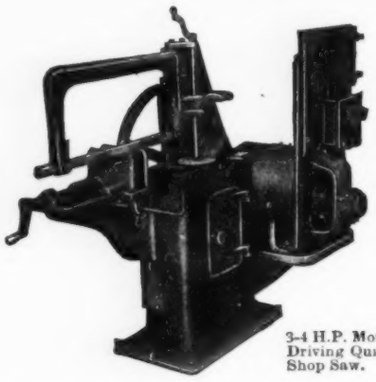

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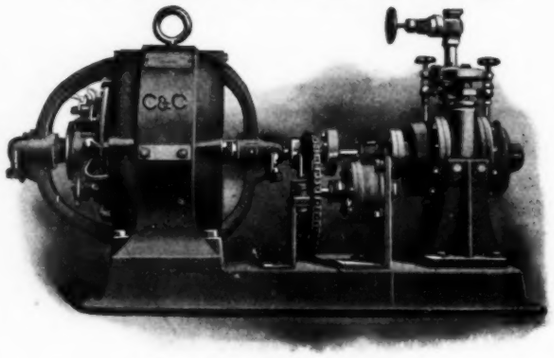

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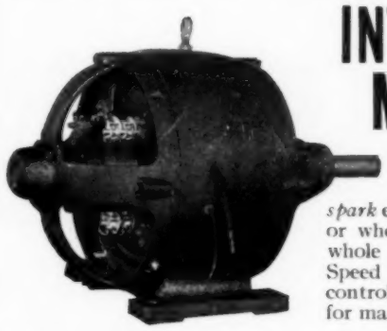


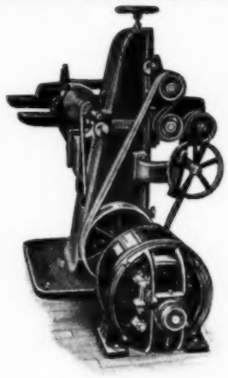
INTER-POLE MOTORS

have wide speed range and *will not spark* even under overloads, or when reversed, over the whole range of speeds. Speed is constant on any controller position. Ideal for machine tool drive.

BULLETIN 7

ELECTRO DYNAMIC CO., BAYONNE, N. J.

ARCADE BLDG., PHILADELPHIA, PA. 200 NINTH ST., PITTSBURG.
MONADNOCK BLDG., CHICAGO.



A

TRIUMPH

WILL DO IT!

WHY?

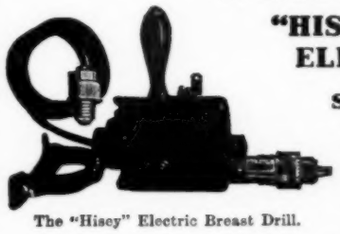
ASK FOR OUR BOOKLET

"THE WAY TO FORGET"

TRIUMPH ELECTRIC COMPANY
CINCINNATI, OHIO

REDUCE YOUR COSTS
BY USING THE

"HISEY" PORTABLE ELECTRIC TOOLS



The "Hisey" Electric Breast Drill.

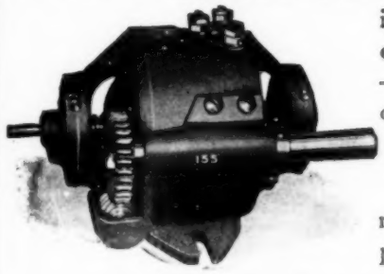
Sent on trial

7 sizes: ¼ in., ⅜-in., ½ in., ⅝-in., ¾-in., 1¼ in., 2-in. capacities. Chuck arranged for close corner drilling. Speed can be changed while running. Extra side handle for use as Breast Drill. Screw-feed and "Old Man" for larger sizes.

Also full line of Tool-post Grinders up to 2 H. P.
Direct or alternating current.

THE HISEY-WOLF MACHINE CO.,
New York Office: 50 Church St. **CINCINNATI, OHIO.**

A VERY SLOW SPEED SHAFT

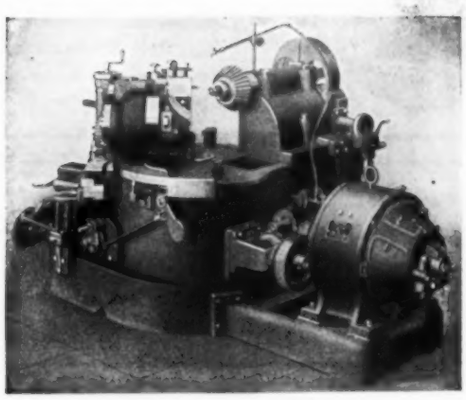


is sometimes needed on an Electric Motor — the slowest one on this

ROTH MOTOR

runs about 4 Rev. per Min.

ROTH BROS. & CO.,
25 S. Clinton Street, CHICAGO, ILL.
NEW YORK—136 LIBERTY STREET.



Westinghouse Motor Driving Gleason Bevel Gear Planer.

A Westinghouse motor direct connected to a machine has many advantages,

both direct and indirect, which result in economy, reduced labor and increased output. This means a decrease in the cost of the product per unit of output, and at the same time an increase in the revenue from the investment in costly machines and tools. The decreased cost will vary with different installations and operating conditions.

Ask nearest office for information.

Westinghouse Electric & Mfg. Co.

Atlanta	Cincinnati	Kansas City	New York	Salt Lake City
Baltimore	Cleveland	Los Angeles	Philadelphia	San Francisco
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Canada: Canadian Westinghouse Co., Ltd., Hamilton, Ont.
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When you order **HORTON CHUCKS** see to it that our trade mark "Horton, Reg. U. S. Patent Office" is stamped plainly on their face; all others are imitations.

The E. Horton & Son Company,
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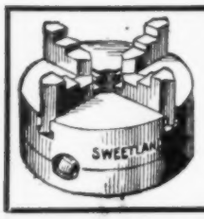
Or Chas. Churchill Co., Ltd., London, Birmingham, Manchester and Glasgow. Schuchardt & Schutte, Berlin, Cologne, Vienna, Stockholm, St. Petersburg and New York. Fenwick Freres & Co., Paris, France. Van Reitschoten & Houwens, Rotterdam, Holland.



The Jaw of a Sweetland Scroll Chuck is *solid* and *reversible*. You'll find this feature in no other Scroll Chuck but the "Sweetland." Sweetland Chucks are best from *all* standpoints. Write!

The Hoggson & Pettis Mfg. Co.
New Haven, Conn.
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Nothing to get out of order—it is too simple for that.

The Reid Drill Chuck
takes hold firmly, without damage to the drill, and keeps the hold 'till you release the differential screw.

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New Haven, Conn.

ASK FOR THE { Plurality Die Bolt Cutter / Combined Revolving Oilstone and Grinder / Universal Edge Tool Grinder

Circulars

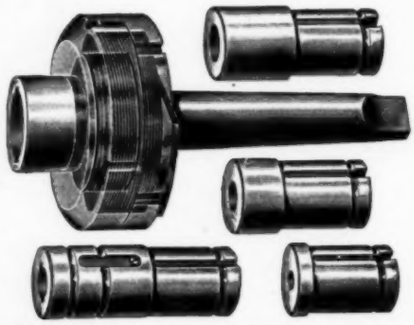
MUMMERT, WOLF & DIXON COMPANY,
Hanover, Penna.

The Safety Drill & Tap Holder

is the only attachment for the purpose that gives universal satisfaction and is

Unequaled for Efficiency, Convenience, Rapidity, Accuracy and Simplicity.

Nothing to *break* or get out of *order*. Made in 4 sizes, covering from 0 to 2½ in. diameter.



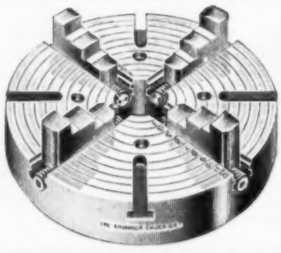
THE BEAMAN & SMITH CO., PROVIDENCE, R. I., U. S. A.

Almond
Inclosed Pinion Drill Chuck

With pinion and gear teeth always in perfect mesh there is practically no opportunity for wear.

T. R. Almond Mfg. Co.,
Ashburnham, Mass.
New York City, 40 Murray St. London Office, 8 White St., Moorefields.

HOLDS THE WORK TRUE

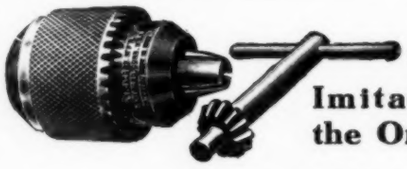


The Skinner **"1904 Pattern" Independent Lathe Chuck** will hold your work true because it has raised and ground steps on the jaws.

The jaw screws are hardened and securely held in position in the chuck body. The solid half nut jaws reverse by running them out of the periphery of the chuck.

THE SKINNER CHUCK COMPANY,
NEW BRITAIN, CONN., U. S. A.
94 Reade St., New York City.
78-80 City Road, London, E. C.

It's Good Enough To Imitate, It's Good Enough For You.



Why use an Imitation? Use the Original.

Manufactured only by
The Jacobs Manufacturing Company,
Hartford, Conn., U. S. A.

UNION GEARED DRILL CHUCK

Internal Gear with teeth always in line. No breakage of teeth or wrench

Made only by
UNION MANUFACTURING COMPANY,
New Britain, Conn., U. S. A.
26 Cortlandt St., New York.

Strength
Rigidity
Time Saving
Rapidity

Cushman Universal Geared Scroll Chucks are so built, along lines of Cushman Quality, that they stand the hardest usage without damage or perceptible wear.

1908 Catalog Now Ready—Send for yours.

THE CUSHMAN CHUCK COMPANY, HARTFORD, CONN.

Quick-Change Tool-Holders.

STYLE D

Drills, Taps, Sets Studs in Line.

ERRINGTON AUTO-REVERSE

41 Cortlandt St., New York.

NO { Stopping / Reversing / Moving Work / Changing Speed

TAPPING CHUCK

Fifteen years on the market have taught me

Simple Methods of Handling Work

and how to *ADAPT* my

POSITIVE, FRICTION and INTERCHANGEABLE TAPPING DEVICES

to meet

Every Condition of Tapping.

MADE IN ALL SIZES FROM 1-16 IN. TO 2 IN. TAPS.

Use Style D for work that is clamped down, or work that is too heavy to center itself to the tap.

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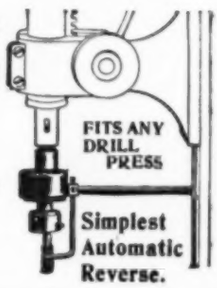
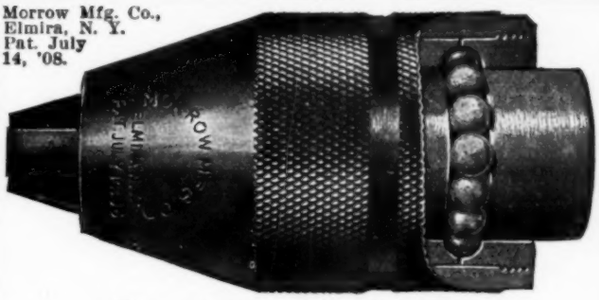


Morrow Mfg. Co., Elmira, N. Y. Pat. July 14, '08.



The only Ball Bearing Chuck

GUARANTEED

Not to slip; To release by hand. Ask about it.

MORROW M'F'G. CO., ELMIRA, N. Y.

The Jaws Of The PRATT CHUCK Don't Do The Driving

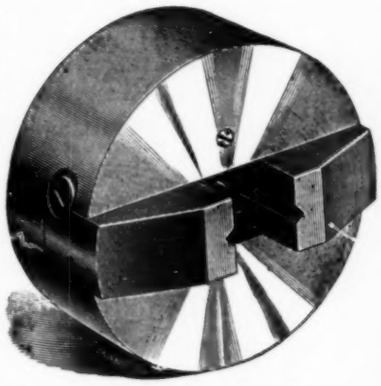
They just center the drill and keep it from falling out. The driving is done in another way, and a way that makes the drive positive and the whole thing doesn't cost any more than chucks that have nothing to co...mend them. Book?

PRATT CHUCK COMPANY

Frankfort, New York, U. S. A.

Sole European Representatives: Selig, Sonnenthal & Co., 85 Queen Victoria St., London, Eng.

A Two Jawed Chuck

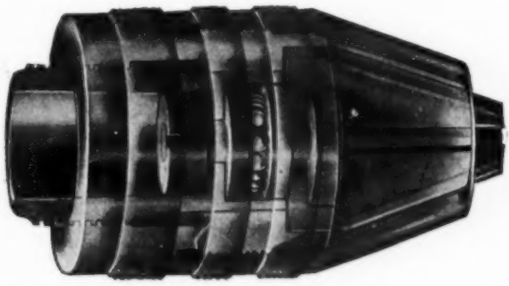


with hardened steel thrust shoulders for retaining screws in place and for receiving wear, and which allows the screw threads to extend fully to the outside of chuck, giving the jaws greater traverse and increasing the safe capacity of the chuck as compared with other chucks of a similar size. May be taken apart for cleaning when necessary without everything falling to pieces. Other chucks, all kinds, for all purposes.

D. E. Whiton Machine Co.,

NEW LONDON, CONN.

European Address: Selig, Sonnenthal & Co., 85 Queen Victoria St., London, E. C.
"Whiton" Chucks are Sold and Kept in Stock by Principal Dealers All Over Europe.



THE original and only ball bearing anti-friction Drill Chuck that will **positively hold a Straight Shank Drill without slipping.** Others may imitate, but **none** equal.

THE CHUCK WITH A GRIP IT WILL NOT SLIP.

Operated by hand—no key, no wrench, no spanner.

A time and money saver—thousands in use.

Made in five sizes. *Send for Circular.*

RUSSELL ANTI-FRICTION DRILL CHUCK CO., ELMIRA, N. Y.

THE ARITHMETIC OF THE SHOP IS AT YOUR COMMAND IN THIS NEW BOOK

¶ Many a man walks around a shop looking like a human interrogation point.

¶ All you hear from him is this—? ? ? ? ? ?

¶ The boss and the other men may not say much, but you can wager that every question from a man who really *ought to know* lowers him in their estimation — subtracts something from the 16 oz. he ought to weigh to the pound.

¶ The man who depends upon others to tell him what gears to use or the depth of a 9-pitch thread isn't destined to make much headway as a machinist.

¶ Machine Shop Calculations is for the man who prefers to be the questioned rather than the questioner.

¶ The author, whose former book of similiar character is well known, gives only such rules and calculations as have proved useful in the shop.

¶ In each case he has shown the "why" of each step taken so as to make a man as independent as possible of having to remember rules.

¶ Here is a synopsis of the contents:

¶ Common fractions; decimal fractions; cancellation; ratio; percentage; speed of pulleys; speed of gearing; gearing a lathe to cut any thread; screw thread calculations; drilling for taps; taper work; speed of lathes, planers and shapers; square and cube roots; measuring surfaces; contents or volume of solid bodies; measuring angles; making and using formulas; the vernier and micrometer; regular polygons and their properties; the uses of shop "trig;" trigonometry tables.

174 pages, illustrated, cloth bound, price $1.00 postpaid
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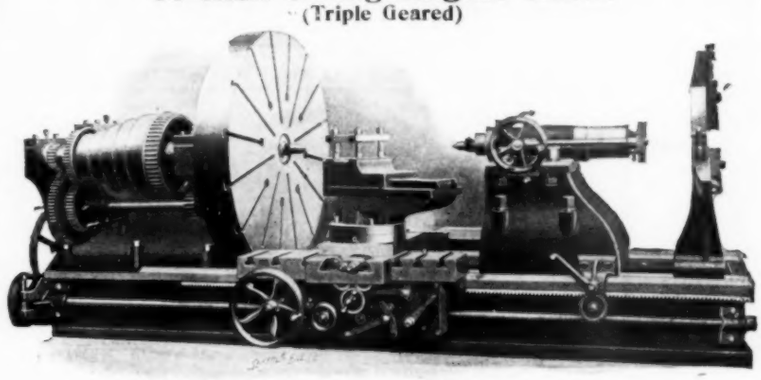
HILL PUBLISHING COMPANY, 505 PEARL STREET, NEW YORK CITY
6 BOUVERIE STREET, LONDON, E. C.

American Machinist *The Engineering and Mining Journal* *Power and The Engineer*

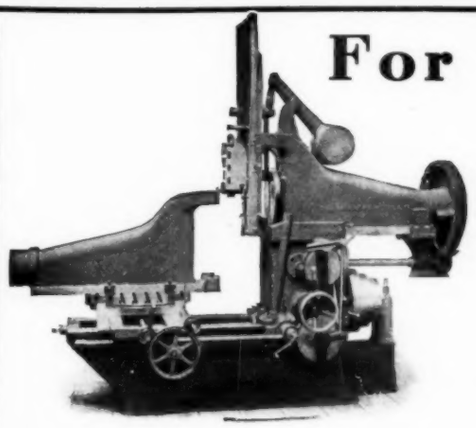
60-Inch Swing Engine Lathe
(Triple Geared)



Severe Service

invariably proves that this 60-inch swing New Haven Engine Lathe is *ideal* for "standing up" under the strains of the hardest modern shop practice. Note the massive and rigid outline. It sets on a wide and deep strongly braced bed, without legs. There are 15 changes of speed and the back gearing is extremely powerful. The whole tool is built like a battleship. Circular describes.

NEW HAVEN MFG. CO.
NEW HAVEN, CONN.



For Cumbersome Work

there isn't another slotter made that can touch the "Dill." If you are working on a big ungainly piece that can't be fed to the tool, the TRAVELING HEAD on the "Dill" enables you to feed the tool to the work.
The "Dill" Book describes the Automatic Knock-Off, the Stroke Indicator, the wide range of Ram Adjustment and tells just WHY the "Dill" is bound to increase your profits Isn't it economy to purchase *one "Dill"* instead of three or four ordinary machines?

The Dill Slotter People, Fairhill P. O., **Philadelphia, Pa.**
Agent for Germany and Austria—Heinrich Dreyer, Berlin, Germany.

ONE-LOCK ADJUSTABLE REAMERS

Are Excellent Tools for the Busy Shop

Accuracy

One-Lock Reamers guarantee the maintenance of manufacturing standards or limit of variation.

Convenience

Accurate adjustment of all blades at once is obtained in one minute by *Rotating* the *Cam Bolt*.

Economy

Every set of blades in the *One-Lock Reamer* outlasts ten solid reamers, giving you *ten reamers for the price of one*. *Get Catalog AA*.

Wm. J. Smith Co., New Haven, Conn., U. S. A. Pacific Coast Agents: Fred. Ward & Son, Inc., First and Howard Streets, San Francisco, Cal.

Machine Screws and Small Parts

How Are You Doing Work of This Character?

We make a specialty of relieving concerns from such work; saving them money, and guaranteeing the highest quality standard of production. Brass, Iron or Steel. Send samples for estimate.

Universal Machine Screw Company
HARTFORD, CONN.
Also Manufacturers of the Universal Five Spindle Automatic Screw Machines.

"TO SEE IS TO BUY"

We can meet your ideas quite well as to price on these 2nd-hand Tools

Combination Stud and Chuck. Lathe, 20" Sw., 7' bed, "Bullard"
Screw Machine, 2" Wire-feed, complete, "Pratt & Whitney"
Plain Turret Lathe, 16"x4', Back-geared, "Warner & Swasey"
Radial, 84" Swing, with Tapping attachment, "Standard"
Upright Drill, 24" Swing, Sliding-hd., Back-gears, "Sibley & W."
Cutting-off Machine, 2" "Betts"
Gear Cutter, 22" Spur and Bevel, Automatic, "Brown & Sharpe"
Gear Cutter, 18" Spur and Bevel, Automatic, "Gould & Eber."
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TRIPLE-GEARED LATHES

66"	Swing,	Double-head	Driving-wheel Lathe, "Niles"
62"	"	24' bed,	extra heavy, "Fifield"
50"	"	22' "	"Putnam"
42"	"	14' "	Quick-change, Tr-grd., "Schumacher & B."
32"	"	12' "	"Standard"
23-40"	"	18' "	Gap, Extension-bed, "Philadelphia"

LO-SWING LATHE

Latest Pattern, good as new, "Fitchburg,"—exceptionally low price to move it quick.

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All the Standard Sizes, "Putnam," "Fitchburg," "Schumacher & Boye"—and the best makes

LARGE PLANERS

54" wide	x 54" high	x 16' long,	"Sellers," Four-heads
50" "	x 50" "	x 16' "	"Bement," One Hd. Rail one side
48" "	x 48" "	x 18' "	"Gray," Three Heads
42" "	x 42" "	x 18' "	"Niles," Two Heads
42" "	x 34" "	x 8' "	"Pease," One Head
36" "	x 36" "	x 10' "	"Standard," One Head

OTHER PLANERS, 30", 27", 26" and 24" wide

Punches & Shears, Riveting Machines, Shapers, Etc.

J. J. McCABE, No. 30 Church St., New York City

ALWAYS THE BEST

USED MACHINERY

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21 in. x 8 ft. Davis & Egan C. R. P. C. F.
24 in x 14 ft. Lodge & Shipley, triple geared
31 in. x 14 ft. Putnam, C. R. P. C. F.
36 in. x 15 ft. Lathe & Morse, C. R. P. C. F.
16 in. x 10 ft. Automatic Threading Lathe
37 in. x 11 ft. Putnam C. R. P. C. F.
106 in. x 35 ft. Bement trp. grd.

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26 in. x and 50 in. Stevens double tool blocks
60 in. x 10 in. New Haven triple geared

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No. 2 Pratt & Whitney hand
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No. 14 Garvin plain, all geared feed
No. 1 Milwaukee Universal
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No. 12 Becker-Brainard Universal
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20 in. Snyder Plain Lever
36 in. Hamilton, B. G. F. F.
4 ft., 5 ft. and 6 ft. Bickford plain radials
4 ft. and 5 ft. Bickford universal radials

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16 in. Gould & Eberhardt crank
20 in. Gould & Eberhardt crank
24 in. Hendey friction
30 in. Juengst friction
48 in. Morton draw stroke

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36 in. Brown & Sharpe vertical Chucking
51 in. Niles vertical two heads
No. 1 Barret horizontal, 4 in. bar

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18 in. and 26 in. Brown & Sharpe
33 in. and 50 in. Gould & Eberhardt
42 in., 60 in. and 63 in. Gould & Eberhardt spur

PRESSES

No. 3 Bazendale Inclinable
No. 5 Mossberg & Granville inclinable
No. 5 Bliss double crank geared
No. 1½ Bliss toggle drawing

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22 in. x 22 in. x 4 ft. Powell one head
26 in. x 24 in. x 6 ft. Ferris & Miles one head
32 in. x 32 in. x 8 ft. Smith & Silk two heads
32 in. x 32 in. x 8 ft. Pease one head
33 in. x 33 in. x 8 Betts
36 in. x 36 in. x 14 ft. Bement Miles two heads
50 in. x 26 in. x 14 ft. Pond two heads
60 in. x 60 in. x 22 ft. Hepworth one head

SCREW MACHINES AND MONITORS

¾ in. Acme, full automatic
⅝ in. Warner & Swasey wire feed
1⅝ in. Warner & Swasey W. F.
2 in. x 24 in. Jones & Lamson flat turret
24 in. and 27 in. American turret lathe
No. 6 Brown & Sharpe friction head monitor
1⅝ in. Spencer double end automatic screw machine
1½ in. and 2½ in. Cleveland automatic

HAMMERS

50 lbs. and 200 lbs. drops Peck lift
800 lbs. and 1200 lbs. board drop
50 lb. Dupont trip

MISCELLANEOUS

Buffalo steel plate steam driven fan
79 in. Bement driving wheel lathe
10 in., 12 in. and 14 in. slotters
42 in. Gap Punch and Shear

WANTED

Some Good Second-Hand Lathes, Drills and Shapers

PRENTISS TOOL AND SUPPLY CO.,

NEW YORK	BOSTON	BUFFALO	SYRACUSE
115 Liberty St.	145 Oliver St.	607 D S Morgan Bldg.	522 University Block.

SECOND-HAND MACHINERY

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Pratt & Whitney Turret Boring Machine
2¾ in Niles Horizontal, back geared, belt feed
48 in. Niles Car Wheel, three jaw comb. chuck table
60 in. Niles Pulley Boring Machine

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Barnes Friction Driven Bench
Hoefer Sensitive
20 in. Davis, wheel and lever, power feed, back gear
24 in. Sliding Head Back Geared
24 in. Bickford Sliding Head
28 in. Barnes Stationary Head, complete
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Two-Spindle Redington Drill
Four-Spindle Harrington Drill
4 ft. Cincinnati Plain Radial, rebuilt
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4 ft. Universal Radial Drill Co.'s plain radial

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33 in. x 9 in. Gould & Eberhardt
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New Yankee Drill
14 in. Ransom Disc
8 in. x 26 in. Plain Diamond Roll

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1000 lb. Pratt & Whitney Drop
1100 lb. Friction Board Drop, overhead works

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16 in. x 4 ft. Star, plain rest, power cross feed
11 in. x 4 ft. Barnes screw cutting, comp. rest
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14 in. x 6 ft. Davis, compound rest
16 in. x 6 ft. Fay & Scott, compound rest
14 in. x 6 ft. Flather, plain rest, hollow spindle
15 in. x 8 ft. New Haven, solid spindle
18 in. x 6 ft. Hahn-Mayer-Carpenter, hollow spindle
18 in. x 6 ft. Pond, compound rest
18 in. x 8 ft. Schumacher & Boye, swivel rest, hollow spindle
18 in. x 10 ft. Lodge & Davis, compound rest
19 in. x 14½ ft. American, hollow spindle, rebuilt
20 in. x 10 ft. American, compound rest, rebuilt
21 in. x 8 ft. Bradford, hollow spindle, taper attachment
22 in. x 10 ft. LeBlond, compound rest
24-31 in x 10 ft. American, hollow spindle
24 in. x 12 ft. Hendey, hollow spindle
24 in. x 12 ft. Fifield Triple Geared, hollow spindle
24 in. x 12 ft. Lodge & Shipley, compound rest, five step cone
26 in. x 10 ft. Pond, plain rest
26 in. x 16 ft. Schumacher & Boye engine lathe, hollow spindle
36 in. x 20 ft. New Haven, solid spindle
36/46 in. x 18 ft. Fifield Back Geared

PULLEY AND AXLE LATHES

26 in. Stevens Pulley Lathe
36 in. Niles Pulley Lathe
Pond Single Head Axle Lathe
Bement Single Head Axle Lathe
Schellenbach 40 in. Pulley Boring and Turning Machine

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Jones & Lamson Turret Lathes
14 in. Pratt & Whitney Turret Lathe, plain head
16 in. x 6 ft. Lodge & Davis Turret Lathe
No. 3 Bardons & Oliver Turret Lathe, friction geared head
21 in. Gisholt Turret Lathe
42 in. New Haven Turret Lathe
⅝ in. Garvin Screw Machine
⅞ in. Pratt & Whitney Automatic Screw Machine
2 in. Lodge & Davis Screw Machine
¾ in. Cleveland Automatic Screw Machine
No. 6 American Screw Machine
No. 5⅝ Bardons & Oliver Screw Machine

MILLERS

No. 2 Becker-Brainard Plain Miller
No. 3 Brown & Sharpe Plain, belt feed
No. 3 LeBlond Plain, gear feed
No. 34 Oesterlein Plain, geared feed
Lincoln Pattern Milling Machine
Large Newton Vertical Miller
Newton Double Head Milling Machine

PLANERS

24 in. x 24 in. x 6 ft. American Tool Works Planer, one regular planer head, two milling heads
24 in. x 24 in. x 6 ft. Pease Planer, one rail head
27 in. x 27 in. x 6 ft. New Haven, one rail head
30 in. x 30 in. x 8 ft. Pease, one rail head
36 in. x 30 in. x 10 ft. American Tool Works, two rail heads, rebuilt
30 in. x 30 in. x 14 ft. American Tool Works, two heads, rebuilt
36 in. x 36 in. x 10 ft. Pratt & Whitney, one head
36 in. x 42 in. x 14 ft. American Heavy Pattern, two heads
48 in. x 48 in. x 10 ft. Pratt & Whitney, two rail heads, one side head

MISCELLANEOUS

16 in. Rockford Back Geared Crank Shaper
16 in. Steptoe Crank Shaper
1 in. National Bolt Cutter
Bement Axle Double Head Cut-Off Lathe

Send for our complete list of machine tools.

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SECOND-HAND
HIGH GRADE MACHINERY

BORING MACHINES

1—2B Binsse Horizontal
1—"F" Baker Special
1—3-in. Bar Lucas—42 in. table
2—30 in. Bullard
1—37 in. Bridgeport 1 head
1—84 in. Betts, 2 heads
1—10 ft. Pond floor boring machine

DRILL PRESSES

8—Barnes Friction
4—1-spindle sensitive
3—2-spindle sensitive
1—4-spindle Reed sensitive
1—6-spindle Quint turret
2—20 in. Barnes upright
1—24 in. Pratt & Whitney
2—24 in. Baker High Speed
4—25 in. W. F. & J. Barnes
2—26 in. Lodge & Davis
1—30 in. Prentice Bros. (new)
1—33 in. Bement-Miles
1—34 in. Barnes, gear feed
1—24 in. Fosdick Radial

GEAR CUTTERS

1—Grant-Lees Hobbing Machine
1—30 in. x 8 in. Brainard spur
1—36 in. x 9 in. x 5-P Gould & Eberhardt
2—50 in. x 11 in. x 8-P Gould & Eberhardt

GRINDERS

2—Cincinnati Cutter and Tool
1—Pratt & Whitney cutter and surface
1—No. 2 Brown & Sharpe Universal

LATHES

1—10 in. x 4 ft. Davis
1—14 in. x 6 ft. Prentice, taper attachment
1—14 in. x 6 ft. Flather, compound rest
1—14 in. x 6 ft. Flather, taper attachment
1—14 in. x 6 ft. Hendey, taper attachment
1—14 in. x 6 ft. Whitcomb-Blaisdell, turret on shears
2—14 in. x 6 ft. LeBlond
1—14 in. x 8 ft. Flather
2—15 in. x 6 ft. Blaisdell
1—16 in. x 6 ft. Reed
2—16 in. x 6 ft. Lodge & Shipley
2—16 in. x 6 ft. Pratt & Whitney
1—20 in. x 8 ft. Flather
1—22 in. x 13 ft. Walcott, comp. rest
1—24 in. x 8 ft. Flather,
1—24 in. x 10 ft. Lodge & Barker
1—26 in. x 12 ft. Reed, chuck fitted
1—32 in. x 20 ft. Jackson & Wiley
1—62 in. x 20 ft. Cummer
1—62 in. x 25 ft. Putnam motor driven

LATHES—POLISHING

2—No. 3 Diamond, 52 x 1¾ spindle
2—No. 7G Diamond, 46 x 1¾ spindle

MILLING MACHINES

1—No. 2 Pratt & Whitney, hand
1—No. 3 Garvin, hand
1—No. 1 Pratt & Whitney, plain
1—No. 1 Brainard, universal
1—No. 15 Becker-Brainard universal
1—No. 2 Brown & Sharpe, universal
1—No. 3 Brown & Sharpe universal
6—No. 2 Pratt & Whitney, Lincoln pattern
1—No. 40 Becker-Brainard double-head
1—42 in. x 24 in. x 8 ft. Ingersoll slab

PLANERS

1—20 in. x 20 in. x 4 ft. Wheeler, 1 head
1—24 in. x 24 in. x 6 ft. Cincinnati, 1 head
1—26 in. x 26 in. x 10 ft. Powell 2 heads
1—36 in. x 36 in. x 10 ft. Gray, 1 head arr. for 2
1—42 in. x 36 in. x 14 ft. Cincinnati, 2 heads
1—42 in. x 42 in. x 21 ft. Woodward & Powell, 4 heads

PRESSES

1—D75 Ferracute
1—No. 62 Toledo
1—No. 8 Greenerd arbor

SAWS

1—6 in. Cochrane-Bly
1—6 in. Newton

SHAPERS

1—15 in. Pratt & Whitney tool room
1—16 in. Stockbridge, back geared
1—20 in. Hendey
1—24 in. Gould & Eberhardt
1—24 in. Hendey
1—24 in. Potter & Johnston
1—26 in. Hendey

TURRET LATHE

1—No. 3 Garvin, with collets
2—No. 2 Pratt & Whitney, wire feed
2—No. 3 Pratt & Whitney, wire feed
1—No. 4 Bardons & Oliver
1—No. 5 Warner & Swasey
2—2 in. x 24 in. Jones & Lamson
1—2 in. x 26 in. Pratt & Whitney
1—21 in. Gisholt, with taper attachment
1—22 in. Bullard "B" machine
2—22 in. Lodge & Shipley

THE MOTCH & MERRYWEATHER MACHINERY CO.

707-715 LAKESIDE AVE., N. W., CLEVELAND, OHIO.

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MILLING AND BORING MACHINES

We offer for resale the following tools, many of which are as good as new. We can make very attractive prices on these as we need the floor space for our new tools.

Milling Machines

Brainard plain horizontal, No. 6.
Brainard plain horizontal, No. 7.
Brainard plain hor., No. 5B.
Becker vertical, No. 1.
Becker vertical, No. 6.
Pratt & Whitney plain, No. 1.
Oesterlein plain, No. 20.
Milwaukee plain, No. 2, cone drive, with vertical.
Milwaukee Univ. No. 2.

Milling Machines

Brown & Sharpe plain, No. 1.
Brown & Sharpe plain. 84″ x 16″ Platen.
Kempsmith plain, No. 16.
Kempsmith universal, No. 26
Vanderbeek plain, No. D.

Boring Machines

Newton duplex for Cylinders with two heads, 10″ and 7″
Newton duplex adjustable, for cylinders.
Binsse Boring Machine, No. 7.
Niles Vertical Boring Machine, 60″.
Springfield Horizontal Boring Machine, No. 1.
B. & S. Vertical Chucking Mill, Nos. 1 and 2.
Rogers Vertical Boring Mill, 32″.

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SECOND-HAND MACHINE TOOLS

Located at Boston, Chicago and New York

LATHES

7x32 Bench P. & W.
14″x6′ Putnam Compound
14″x6′ Prentice, compound and taper
16″x6′ Comp. and taper, toolmakers B. & S.
16″x6′ Fitchburg, Compound and taper
16″x6′ Bradford, compound and taper
16″x8′ Putnam Motor drive, 110 V.
16″x6′ Putnam Motor drive, 220 V.
16″x6′ C. R. Prentice
18″x8′ Putnam Motor Drive 110 V.
24″x8′ C. R. Putnam, not screw cutting
24″x12′ Comp. Putnam Motor 110 V.
30″x12′ Comp. & Taper Tri. Gd., Johnson
50″x20′ Pond Comp. Tri. Gd.
48″x10′ Face Plate Lathe

MILLING MACHINES

Kempsmith Hand Miller
Brainerd Index Miller
No. 0 Plain B. & Sharpe
No. 0 Pain Carter & Hakes
No. 2 Plain Garvin
No. 3 Plain Garvin
No. 14 A Plain Garvin
No. 4 Plain B. & S. old style
No. 4½ Plain Becker-Brainard
No. 0 Univ. Van Norman
No. 1 Univ. B. & Sharpe
No. 2A Univ. Owen
No. 4 Univ. B. & S. old style
No. 3 Univ. New Model Becker-Brainard
No. 2 Lincoln P. & W.
No. 2 Single Spindle Profiler Garvin
No. 13 New Model Profiler P. & W.

RAILROAD MACHINERY

Bement Single Axle Lathes
Bement Double Axle Lathes
No. 2 Miles Double Axle Lathes
No. 3 Putnam Extra Heavy Dbl. Axle Lathe
36″ Baker Bros. Car Wheel Borer
300 tons 48″ Niles Hydrostatic Wheel Press
46″ Bement Double Car Wheel Lathe
90″ Putnam Double Driving Wheel Lathe

PLANERS AND SHAPERS

16″x16″x4′ P. & W.
17″x17″x4′ Whitcomb
22″x22″x5′ Putnam
22″x22″x6′ Putnam
24″x24″x6′ Putnam 110 V. motor
26″x26″x8′ Pond
30″x30″x24′ 2-Hds. Sellers
36″x36″x14′ 1-Hd. Sellers
48″x48″x9′ 1-Hd., Hewes & Phillips
72″x72″x24′ 3-Hds., Bement
72″x72″x24′ 4-Hds., Sellers
18″x9′ Bed Double Hd. Shaper Cincinnati
20″ Pillar Shaper Hendy
15″ " " "

BORING MILLS

37″ 2-Hds. Vert. Bullard
21′ 3-Hds. Vert. Motor Drive, Pond
36″ Vert. Turret Borer, B. & S.
96″ Swing Special Cylinder Borer
¾″ 00 Garvin Wire Feed
½″ No. 1 P. & W. Wire Feed
⅜″ No. 2 P. & W. Wire Feed
1¼″ No. 3 B. & O. Wire Feed Geared Head
1½″ No. 3 P. & W. Wire Feed Geared Head
2″ No. 3 P. & W. Wire Feed
2″x24″ Warner & S. Hollow Hex. Turret
2″x24″ Flat Turret J. & L.
24″ American Conradson Turret
24″ Gisholt Turret
⅜″ No. 0 Hartford Automatic Stud Mach.
⅜″ Cleveland Automatic Stud Mach.
¼″ No. 00 P. & W. Automatic Screw Mach.
5-16″ No. 0 P. & W. 2 Spindle Automatic Screw Machine
⅜″ No. 1 Acme old style for spindle auto.
21-32″ No. 2 old style B. & S. automatic
½″ No. 1 P. & W. 2-spindle automatic
½″ No. 1 Spencer Single Turret
½″ No. 1 Spencer Double Turret
⅞″ No. 2 P. & W. Automatic
⅞″ No. 2 P. & W. 2 spindle automatic
1″ No. 2 Hartford Automatic
1⅜″ Hartford Automatic
1⅜″ P. & W. Automatic
2-semi. autos., Potter & J.

MISCELLANEOUS

3″ Capacity No. 11 Higley Cold Saw
30″ Draw Stroke Sitoter Baker Bros.
No. 6 Bulldozer Williams White
No. 3 Cutter Grinder B. & S.
Single Spindle Sensitive Drills
Multiple Spindle Drills
Upright Drills 24″ and 32″
6′ Radial Drill Niles
Adjustable Multiple Spindle Drills
Cleveland Wall Radial Countersinking Drill

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MACHINERY SALE

The Plant of the Safety Folding Bed Co., Detroit, Mich., having been purchased by us, we are offering all MACHINERY therein at SPECIALLY LOW PRICES.

Engine Lathe, 11″x5′ Reed, with chuck.
Engine Lathe, 24″x12′ American Tool Wks. Q. C. Gear, with Univ. Chk.
Engine Lathe, 12″x6½′ Fairbanks, with two chucks.
Engine Lathe, 12″x5′ Davis, rise and fall rest.
Engine Lathe, 30″x12′ Fitchburg, raising blocks for 44″.
Turret Lathe, No. 22 Garvin, 14″ Pl. Hd. with dbl. cut-off.
Speed Lathe, 11″x4′ Blount with chuck.
Speed Lathe, 16″ with countershaft.
Polishing Lathe, Dbl. End, Delano.
Shaper, 15″ Hendey Pillar with vise and countershaft.
Shaper, 16″ F. F. Chase. Crank with vise and cs.
Drill, 2½′ arm Fosdick Radial with tapping attach.
Drill, 28″ Barnes with chuck.
Drill, 20″ Barnes sq. base, W. & L. feed.
Drill, Barnes Bench Fric. Disc.
Drill, No. 7 Barnes 15″ with chuck.
Drill, 20″ Snyder sq. base with chuck.
Grindstone Frame, Athol, iron, stone 26″x4″.
Emery Grinder on column, dbl. end, with cs.
Emery Grinder No. 3 Detroit with cs.
Hack Saw, Power, small size.
Press, No. 6 Niagara, O. B. Inclinable, with bolster.
Press, No. 3-P Ferracute with bolster.
Press, No. 15-P Danielson deep throat, 17″, 2½″ stroke.
Press, small arch 1″ stroke, 10″ between uprights.
Forming Mach., special Horiz. Gd. Bulldozer type.
Boring & Facing Lathe, Reed.
Shear, Werner's Patent Portable Beam Shear, for hand power, Model B.
Shear, No. A-1 Badger Hand Lever.
Shear, No. 1 Belden Mach. Co. Rod.
Roller Tube Cutter.
Screw Mach., No. 2 Garvin Pl. Hd. 10″ swing.
Screw Mach., 10″ Pratt & Whitney.
Tapping Mach. with countershaft.
Roller Carriage Cut-off Saw.
Blower, No. 1 Sturtevant, furnace and forge.
Foundry Tumbling Barrels, inside measurements, 1—24″x4′x8″ long, direct belt driven; 5—14½″ dia., 2′ long, direct belt driven; 1—34″ dia., 4′5″ long, back gd.; 2—26″ dia., 4′5″ long, bk.gd.
Saw Table, dbl. arbor rip and cut-off.
Time Clock, 100-key International.
Time Clock, 100-key Bundey.
Vises, 1—5″ Plain; 3—3½″ Plain; 7—4″ Plain; 2—4½″ Swivel; 1—5″ Swivel.
Portable Forge, Pipe Cutter, Anvils, Hand Trucks, Standing Desk, No. 2 Smith Premier Typewriter, Shafting, Hangers, Pulleys, Couplings, Belting, 2″ to 8″ wide, all lengths, both single and double.

C. C. WORMER MACHINERY CO.,
57-63 Woodbridge Street, DETROIT, MICH.

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84 in. x 40 ft. Putnam
36 in. x 12 ft. Putnam, Rod Feed
32 in.-58 in. x 16 ft. Rod Feed Gap Lathe
24 in. x 9 ft. Pond, Rod Feed
24 in. x 14 ft. Betts
20 in. x 13 ft. Betts
20 in. x 8 ft. Pond, Rod Feed
20 in. x 8 ft. Betts
19 in. x 6 ft. Pond
18 in. x 8 ft Wood & Light
Complete stock of 16 in. x 6 ft., 14 in. x 6 ft. and 12 ft. Lathes always on hand

SHAPERS
20 in. x 30 in Pedrick & Ayer, open side
18 in. Hendey 18 in. Ohio
18 in. Ohio Shaper, new
16 in. Ohio Shaper, new 9 in. x 36 in. Sellers
16 in. Pratt & Whitney 16 in. Juengst
13 in. x 22 in. English, Traveling Head
Several small Shapers carried in stock

HAMMERS
2500 lb. Morgan, Double Frame 400 lb. Merrell
1000 lb. Chambersburg Steam Drop
800 lb. Pratt & Whitney Board Drop
250 lb. Morgan, Steam 50 lb. Morgan, Steam
No. 2 Hawkeye Trip No. 0 Dupont
Williams & White No. 4 Rivetter

SLOTTERS
12 in. New Haven 16 in. Lowell Machine Co.
6 in. Hewes & Phillips

PLANERS
84 in. x 84 in. x 27 ft. Lowell, 2 heads
84 in. x 84 in. x 24 ft. Putnam, 1 head
37 in. x 33 in. x 10 ft. Bement
36 in. x 36 in. x 18 ft. Niles, 4 heads
36 in. x 36 in. x 11 ft. Sellers
30 in. x 30 in. x 12 ft. Bement, 2 heads
Several 18 in., 16 in. 18 in. Planers on hand

MISCELLANEOUS
No. 5 Cincinnati Double End Punch and Shears, 8 in. Throat
16 in x 30 in. Iroquois Universal Grinder
No. 11 Higley Cold Saw
S 22 Farracute Press
4½ in. x 48 in. Burr Shaft Keyseater with Routing Attachment
52 in. Bement Boring Mill
48 in. Hor. Boring Mill
60 in. Harrington Pulley Borer
No. 4 Hibbard Punch Press
Full Stock of Presses, both new and second-hand
2—30 in. Bullard Vertical Head Boring Mills

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We are dismantling the plant of the Crown Drilling Machine Co., Akron, Ohio, containing the following Machinery:

LATHES.
14x 6 Prentice Bros. Lathe, compound rest. taper attachment, 14″ chuck.
14x 6 Prentice Bros. Lathe, compound rest, taper attachment, 10″ chuck.
18x 8 Bradford Lathe, compound rest, 12″ chuck fitted.
18x 8 W. P. Davis Lathe, compound rest, 12″ chuck.
20x10 Flather Lathe, quick change gear, compound rest, 14″ chuck.
26x15 Schumacher & Boye Lathe, compound rest, fitted with taper attachment, 18″ chuck.
27x16 Draper Lathe, compound rest, 24″ chuck.
30x12 Lodge & Shipley Lathe, quick change gear, compound rest, 30″ chuck fitted.
30x16 Lodge & Shipley patent head Lathe, quick change gear, compound rest, 6″ hole in spindle fitted with taper attachment, 20″ chuck.
42x24 American Tool Works Lathe, compound rest, has raising blocks to swing 60″, fitted with four face plate jaws.

DRILLS.
14″ Barr Sensitive Drill and chuck.
22½″ Barnes Drill Lever feed.
24″ Aurora Drill, Back Geared, Power Feed, Automatic Stop.
42″ Cincinnati Machine Tool Co. Drill, Back Geared, Power Feed, Automatic Stop.

SHAPERS AND PLANERS
24″ Stroke Smith & Mills Shaper.
24″ Stroke Cincinnati Back Geared Crank Shaper.
30x30x8 Woodward & Powell Planer.

MISCELLANEOUS
Mitts & Merrill Keyseater & Tools.
2″ National Bolt Cutter with taps and dies
No. 4 Brown & Sharpe Universal Miller with attachments.
1100 lb. Bement-Niles Single Frame Steam Hammer, with lot of tools.
Several Chain Falls, Vises, Blacksmith Tools, Anvils, etc.

Inspection can be made by calling at the above plant. We will start removal December 26.

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For originating and testing gauges accurate to .0001 of an inch.

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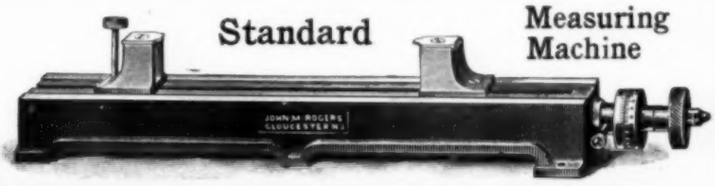
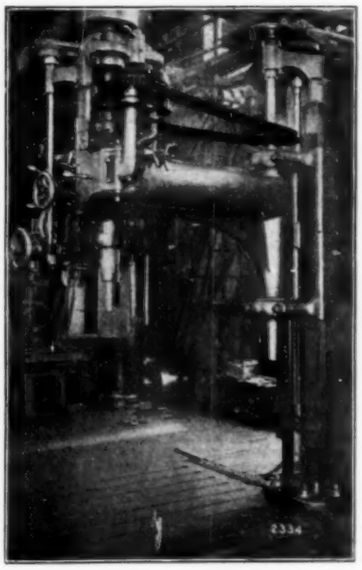
Standard Measuring Machine





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has greater power per inch of width; and furthermore its efficiency doesn't vary: over 98% registered constantly.

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Shaft Coupling will resist the strain on a 5-inch shaft sufficient to twist off the shaft itself. The tapering bore castings are drawn together over four double tapering steel jaws, thus making a four-sided grip.

Write for circular.

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A. WARDEN & COMPANY, England, Main Office, London.

ANNOUNCEMENT

A new machine for the making of small duplicate parts from metal bars will be illustrated and described in detail on this page in the next issue.

It'll make more, earn more and save more than any machine built for the same purpose.

Read this page next week or write for particulars.

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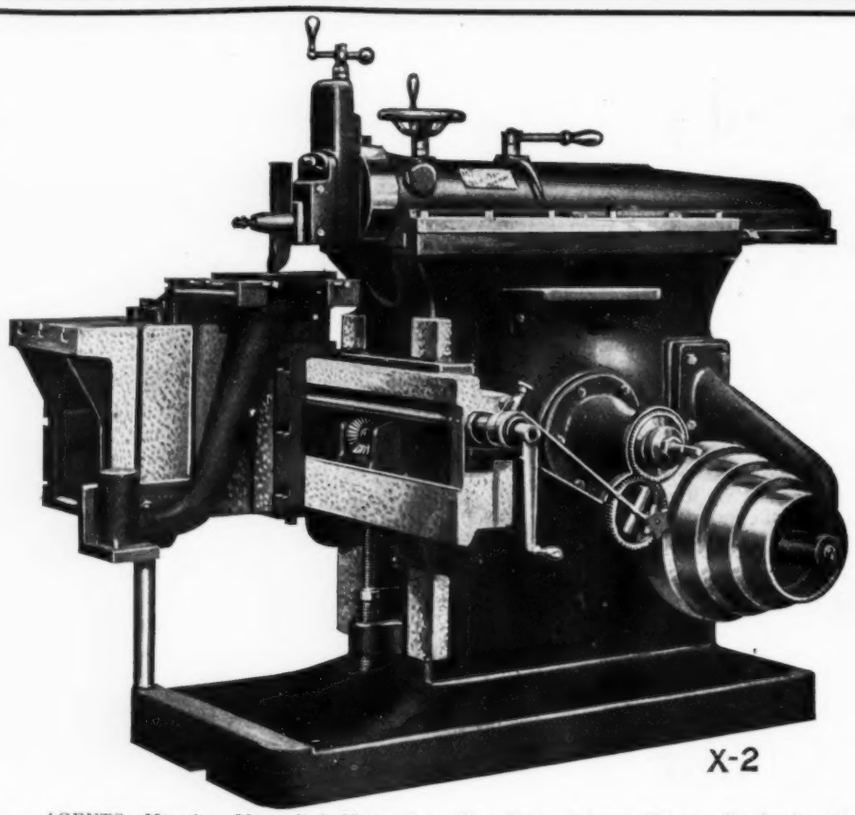

In our shop we find many manufacturing operations that can better be done on a shaper than on any other machine.

Possibly the operation shown may suggest to you some use for a "CINCINNATI" shaper in your shop.

The Cincinnati Shaper Company,

Cincinnati, Ohio, U. S. A.

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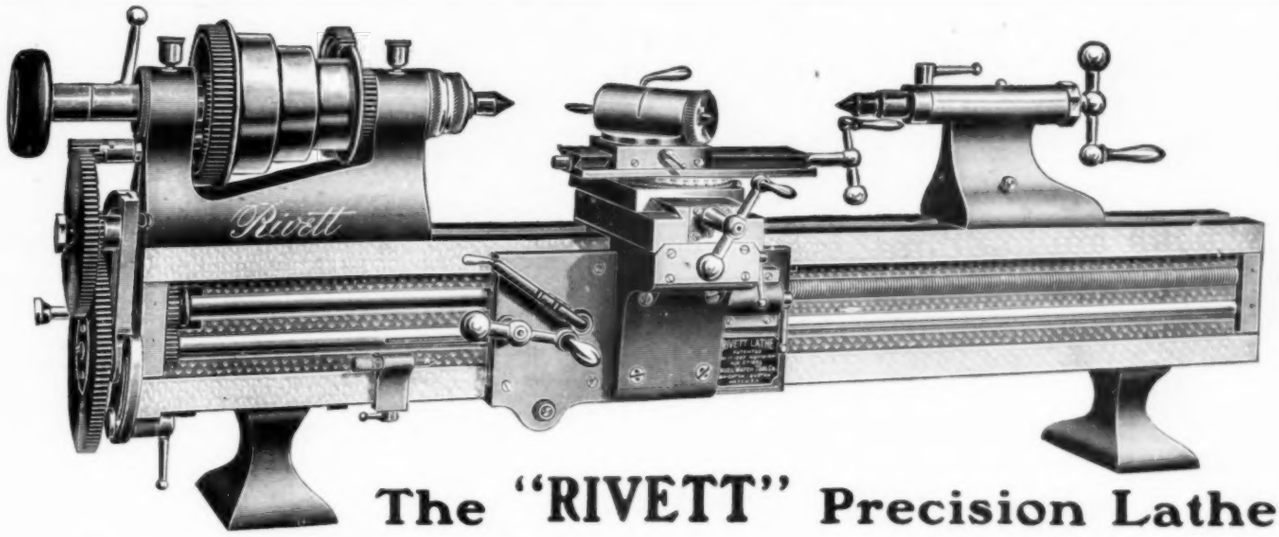

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For work requiring extreme accuracy.

Just the lathe for tool makers, inventors, scientists, and any others who produce small work of extreme accuracy. It will take rough work if it is necessary.

Built by high grade workmen of the best materials, it has full adjustments on all movements. The sliding surfaces are accurately scraped, and all bearings ground true. The lead screw is as perfect as can possible be made; is of large diameter to avoid torsional effects.

We make 5 sizes of Bench and Tool Room Lathes for $100.00 up having wide adaptability.

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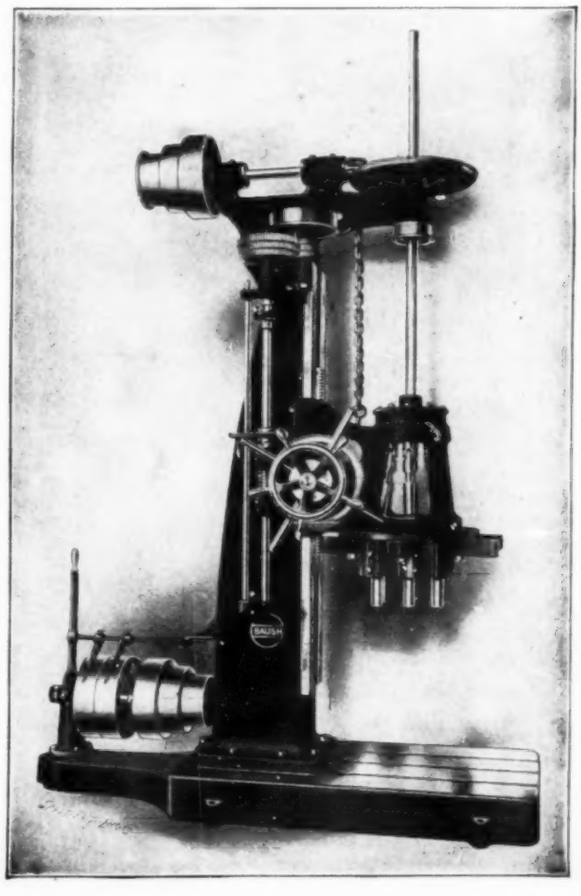

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